TWENTY-SIXTH YEAR

The Heating and Ventilating Magazine

A Monthly Journal of Engineering Progress

Vol. XXVI. No. 2.
$3 a year. 30 cents a copy.

FEBRUARY, 1929

Heating & Ventilating Magazine Co.
243 West 39th Street, New York.

SARCO'S
Proven Advantages
—Try to Match Them

Large diameter helical bellows insures even distribution of movement and long life.

A full ¼" movement gives rapid circulation and extra large capacity.

No steam or vapor can enter the return.

No water hammer. Absolutely noiseless in operation.

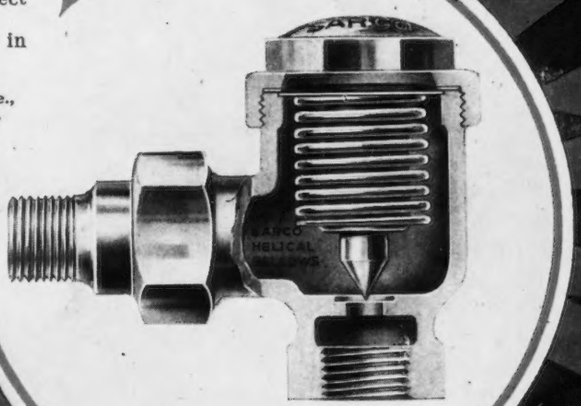
Cannot air bind or freeze.

Self-cleaning. Scale and dirt cannot collect in valve.

Other important advantages explained in Booklet P-110. Write for a copy.

SARCO CO., Inc. 183 Madison Ave., New York, N. Y.

Branches in Principal Cities



SARCO
RADIATOR TRAPS

The two deflectors furnished as standard equipment on the ceiling unit (shown at left) direct the heated air downward to floor line, the warm air reaching the floor level at sufficiently high velocity to penetrate and break up the cold air strata. This means successful heating of the working area.

Announcing

the New Type D Unit Heater

HERE is the satisfactory answer to a great many factory heating problems. The new Clarage Type D is well designed, substantially built—and the price exceptionally low.

It can be used wherever it is practical to install a propeller fan unit heater—particularly where it is desirable to discharge a continuous stream of heated air in one direction. One unit will care for a cold spot or small room; a battery of units produces uniform, agreeable temperatures throughout an entire plant, warehouse, large garage, etc.

The heating element is Aerofin in different types for steam pressures to 350 pounds. The motor furnished can be operated from the lighting circuit. Deliveries from stock on units equipped with 60 cycle, 110 volt, single phase motors.

If you are interested in results at low cost, don't overlook this new Clarage development. Our quotation covering your requirements will prove convincing. Write for Bulletin.

ABOVE—Type D Unit Heater equipped with recirculating box for wall or floor installation. Both ceiling and floor units have same capacity.

CLARAGE FAN COMPANY, Kalamazoo, Michigan

Sales Engineering Offices in Principal Cities

CLARAGE

UNIT HEATERS

with AEROFIN STANDARD EQUIPMENT

All Clarage Unit Heaters utilizing steam or hot water have Aerofin (The Standardized Light Weight Heater) as the heating element. Aerofin is made of copper and brass—non-corrosive, imperishable, light-weight. It is highly efficient, guaranteed steam and water tight. Engineers endorse it.

KEWANEE

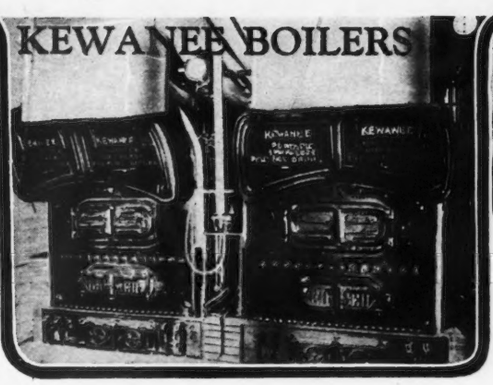
in the banks

Davenport has the *first* First National Bank chartered in U. S. New York City has the *largest.* Both are Kewanee heated.

In the largest and in the very first

KEWANEE BOILERS

NATIONAL CITY BANK BUILDING, NEW YORK CITY. Architects, McKim, Mead and White. Heating Contractors, Baker, Smith & Co. Builders, Geo. A. Fuller Company. Five No. 322 Kewanee Portable Smokeless Boilers; one No. 313 Kewanee Portable Smokeless Boiler. 106,000 square feet total rated capacity.



FIRST NATIONAL BANK OF DAVENPORT. Architects, Childs & Smith. Heating Contractors, Ryan Plumbing & Heating Company. Two No. 317 Kewanee Portable Smokeless Boilers. 1,100,000 cubic feet contents; 12,598 square feet direct radiation; 645 square feet blast. Fan, 10,000 cubic feet per minute.

Kewanee is in hundreds of banks

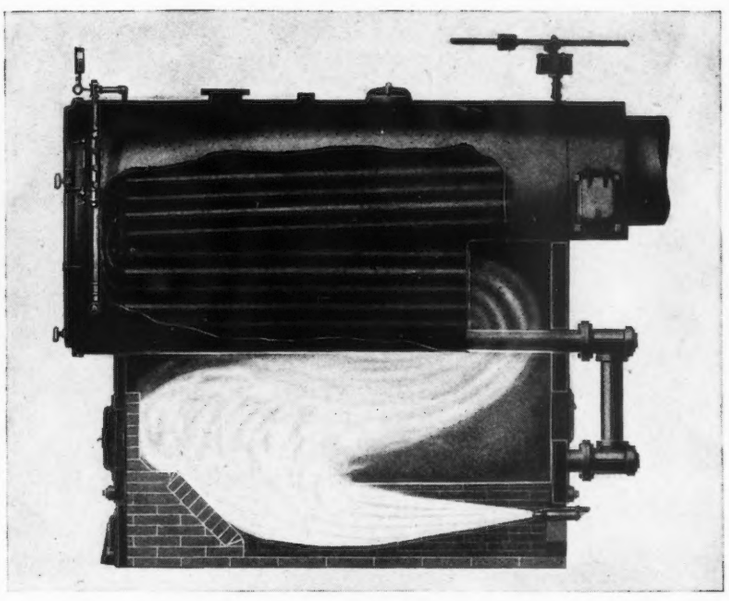
A Kewanee Boiler in your building means money in your bank

KEWANEE BOILER CORPORATION *Kewanee, Illinois*

HISTORICAL NOTE: President Lincoln approved the National Bank Act February 25, 1863, and on the next day an application for a charter for the First National Bank of Davenport reached the Treasury Department in Washington. It was well along in the month of May before the articles of association, prepared in the Comptroller's office, were received in Davenport. On May 25 the subscription books for the new institution were opened, and in three days the capital stock of $100,000 had been subscribed. The bank began business June 29, 1863.

THE HEATING AND VENTILATING MAGAZINE, published by NATIONAL TRADE JOURNALS, INC., at 243 West 39th Street, New York, N. Y. Subscription rates: United States, $2.00; Canada, $2.50; Foreign, $3.00. Single copies, 30 cents. Vol. XXVI, No. 2, February, 1929. Entered as second-class matter, April 18, 1925, at the Post-Office at New York, N. Y., under the Act of March 3, 1879.

"He certainly did a wonderful job!"



To receive a builder's praise . . . the kind that brings him back for more . . . and to pocket substantial profit on the job besides is all in the day's work for contractors who install Pacific Steel Heating Boilers.

From the leak-proof electric arc welded seams to the knock-down feature which permits a quick set-up in tight places, the Pacific Boiler was constructed with the steamfitter in mind. Once a Pacific Boiler is set, the steamfitter is through. No going back to the job to fix leaks or adjust petty troubles, for there are none. This simplicity in assembly and certainty of result mean genuine dollar profit for the contractor. In addition, low freight rates and quick delivery, made possible by the fact that Pacific operates both an eastern and middle western plant, are profit advantages of much importance.

And the fact that the builder is getting the efficiency and economy of operation and maintenance found in large commercial boilers undeniably reflects to the credit . . . and future business . . . of the contractor.

PACIFIC

STEEL HEATING BOILERS

AND CAPITOL RADIATORS MAKE A LOGICAL COMBINATION

STEEL HEATING BOILERS · PACIFIC · WAUKEGAN ILLINOIS · TRADE MARK REG. U.S. PAT. OFF.

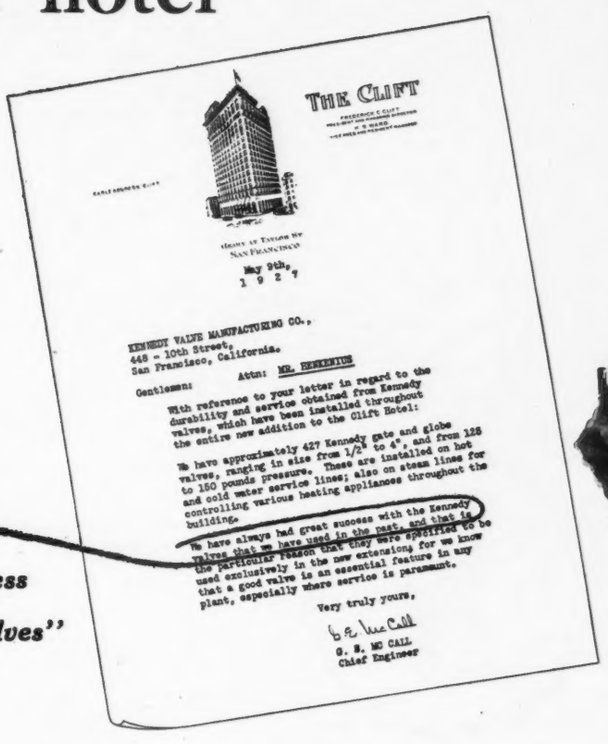
PACIFIC STEEL BOILER CORPORATION

Factories: Waukegan, Ill., Bristol, Pa.

Sales Offices in 58 Cities

Division of United States Radiator Corp., Detroit, Mich.

427 Kennedy Valves in San Francisco's finest hotel


THE CLIFT

May 9th, 1927

KENNEDY VALVE MANUFACTURING CO.,
448 - 10th Street,
San Francisco, California.

Gentlemen: Attn: MR. HERRINTON

With reference to your letter in regard to the durability and service obtained from Kennedy valves, which have been installed throughout the entire new addition to the Clift Hotel:

We have approximately 427 Kennedy gate and globe valves, ranging in size from 1/2" to 4", and from 125 to 150 pounds pressure. These are installed on hot and cold water service lines; also on steam lines for controlling various heating appliances throughout the building.

We have always had great success with the Kennedy valves that we have used in the past, and that is the particular reason that they were specified to be used exclusively in the new extensions for we know that a good valve is an essential feature in any plant, especially where service is paramount.

Very truly yours,

G. S. MC CALL
Chief Engineer

"great success with the Kennedy Valves"

GENERAL CONTRACTOR
P. J. Walker Co., Sharon Bldg., San Francisco
JOBBERS THROUGH WHOM MATERIAL WAS FURNISHED
Geo. H. Tay Co., 165 8th St., San Francisco
Holbrook, Merrill & Stetson, San Francisco
HEATING SUB-CONTRACTOR
James A. Nelson, Inc., 10th and Howard Sts., San Francisco
PLUMBING SUB-CONTRACTOR
Lawson & Drucker, 465 Tehama St., San Francisco

THE 17-story Clift Hotel is the tallest hotel on the Pacific Coast and one of the show places of San Francisco.

The Kennedy Valves which are installed on steam, hot and cold water lines in the first unit of the hotel gave such thorough satisfaction that when the recently completed extension was planned, Kennedy Valves were specified to be used exclusively.

Mr. McCall's letter indicates his keen appreciation of valve dependability as an essential feature of any plant. His faith in Kennedy Valves, founded upon personal experience with a great number of types and sizes on various services, is duplicated by that of thousands of other engineers all over the country. You are safe in standardizing on Kennedy Valves.

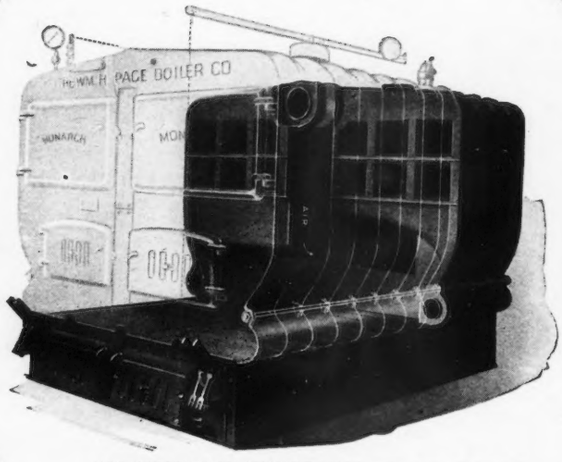
The Kennedy Valve Mfg. Co.
Elmira, N. Y.

New York Chicago San Francisco
Philadelphia Cleveland Atlanta
Los Angeles El Paso Seattle Salt Lake City

KENNEDY

VALVES-PIPE FITTINGS-FIRE HYDRANTS

Price?



60" MONARCH SMOKELESS STEAM BOILER

MANY people think that Page is a much higher priced boiler than it really is. This is not strange when you consider that for more than 70 years the name PAGE has been synonymous with a quality product and heating satisfaction. But the first cost is as low as that of an ordinary boiler, and the fuel expense will be less.

Page Boilers are built for strength and durability, and with care will outlast the building in which they are installed. They are made in all sizes, for very small as well as very large jobs, and are adapted for burning economically any coal, oil or gas. The Monarch Smokeless Boiler illustrated will burn soft coal smokelessly. Approved by communities with most rigid smoke ordinances.

Write for catalogue and profit yielding prices.

The Wm H Page Boiler Co

General Offices: 200 MADISON AVENUE, NEW YORK CITY

BRANCH OFFICES AND WAREHOUSES:

BOSTON, 123 Beverly St.
CLEVELAND, Rose Building.
WASHINGTON, 1117 15th St., N. W.
PHILADELPHIA, 1126 Washington Ave.
BALTIMORE, 502 St. Paul St.
Factory: MEADVILLE, PENNSYLVANIA

Boulevard Recreation Centre

BUILT TO GIVE PLEASURE—

continuous operation of plant assured

by 70 H.P. Coatesville Boiler

The Boulevard Recreation Centre, Tyson Street and Roosevelt Boulevard, Philadelphia, Pa., proved itself an overwhelming success last season, with its dance floor, restaurant and swimming pool.

Good judgment and planning, perhaps, explain this. Among the features of its design will be found a ***70 H.P. Coatesville Heating Boiler*** — (General Contractor, Geo. H. Evans, Inc.; Architect, Edward Schoeppe, both of Philadelphia.)

And Coatesville Boilers are decidedly economical, with low upkeep and maintenance costs . . ***and they're most efficient!***

Coatesville "pioneered" in the All-steel Heating Boiler Field, building their first boiler of that type as early as 1892.

New Series of Heating Bulletins at Request

COATESVILLE BOILER WORKS

Boilers - Tanks - Steel Plate Work

PHILADELPHIA 111 S. 15th St. | PITTSBURGH Union Trust Bldg. | NEW YORK 30 Church St. | BALTIMORE Lexington Bldg. | SAN FRANCISCO 945 Pine St. | BOSTON 141 Milk St. | NEWARK 60 Park Place

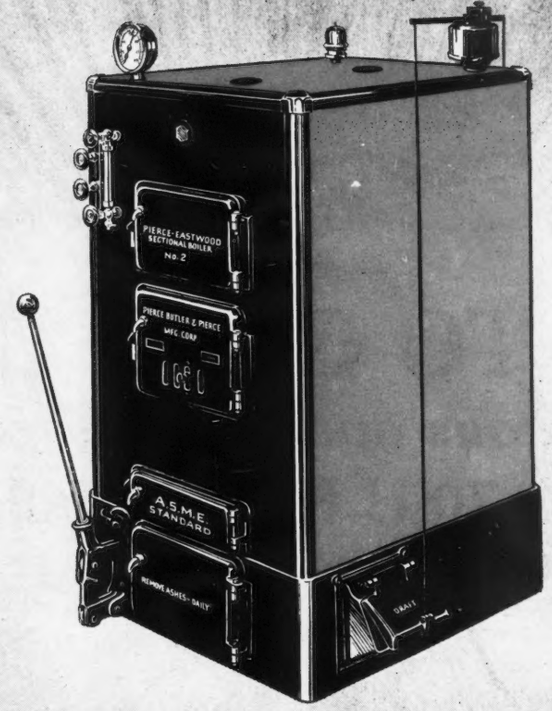
Coatesville All Steel Heating Boilers are also sold by

NATIONAL RADIATOR CORPORATION

Ten plants devoted to National Service through these Branch Offices and Warehouses:

Baltimore, Md.—2622 Frisby Street | Boston, Mass.—93-97 Oliver Street | Milwaukee, Wis.—124-130 Jefferson St. | New York, N. Y.—55 W. 42nd St.
Buffalo, N. Y.—259-265 Delaware Avenue | Louisville, Ky.—1126 W. Breckenridge St.
Chicago, Ill.—2445 N. Keeler Avenue | Cleveland, Ohio—935 E. 63rd Street | Omaha, Neb.—108-112 S. Tenth St. | Philadelphia, Pa.—121 N. Broad St.
Cincinnati, Ohio—Spring Grove and Elmira Avenue | Pittsburgh, Pa.—1509 Arrott Building
Indianapolis, Ind.—431 W. Georgia Street | Johnstown, Pa.—221 Central Ave. | Richmond, Va.—3032 Norfolk St. | St. Louis, Mo.—1042 Central Industrial St.
Washington, D. C.—2205 Fifth Street, N. E.

Inside and Outside—*NEW!*



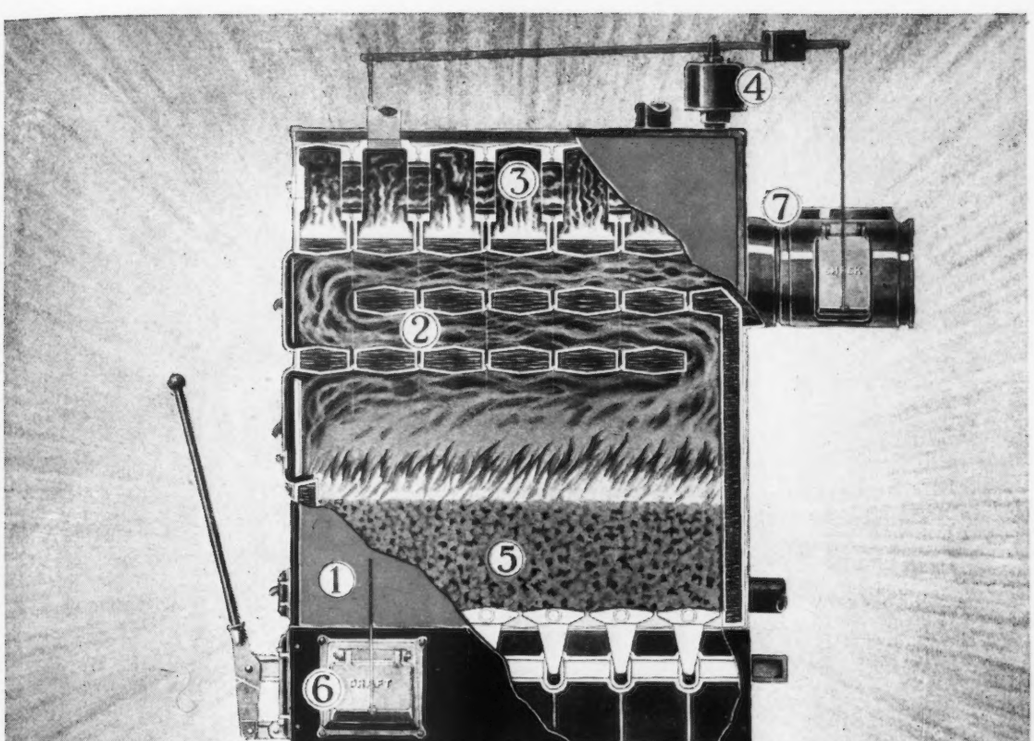
Not an old boiler cut down to fit a new jacket—not just a jacket made to cover a boiler. The new Pierce-Eastwood Sectional Boiler is new inside and out!

It combines proven principles of boiler construction in a heating unit of new design with a trim and sturdy steel jacket of radiant, flaming orange and black.

PIERCE—

BOILERS AND

The PIERCE-EASTWOOD
SECTIONAL BOILER
with 7 super-features



The 7 Super-Features

1. Steel Jacket: beautifully finished in flaming orange and black, to which highly effective insulation is *permanently* attached. Nickel plated trimmings — will not dull, rust or tarnish.
2. Scientifically Designed Flues that compress hot gases against all heating surfaces, assure maximum heat absorption, quick response, greatest efficiency and economy of operation.
3. Large Steam Dome guarantees only dry steam.
4. Improved Automatic Draft Regulation insures uniform steam pressure, constant temperature control, low fuel consumption. Connecting *rods* — no chains to break and get out of adjustment.
5. Ample Grate Area and Fuel Capacity insures long firing periods and requires minimum attention. Flat rocking and shaking grates—easily operated.
6. Side Draft Door: out of the way, trouble proof, cannot clog with ashes.
7. Two-way Smoke Hood.

Tapped for all types of indirect water heaters

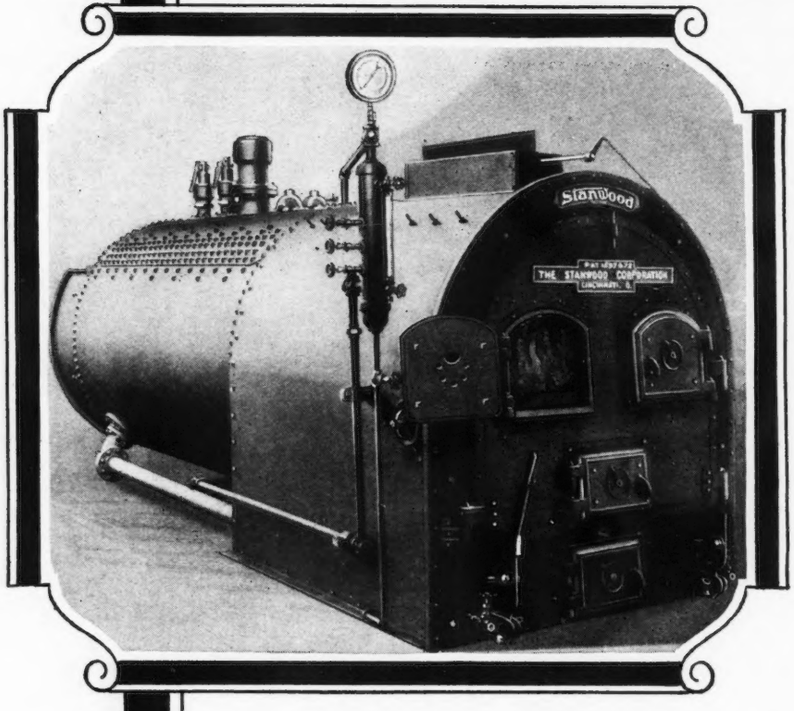
WRITE FOR COMPLETE INFORMATION

PIERCE BUTLER & PIERCE MFG. CORP. — 41 East 42nd Street — New York, N. Y.

Western Distributors — The Kellogg-Mackay Co., 1351 W. 37th Pl., Chicago, Ill.

EASTWOOD
RADIATORS

Stanwood Smokeless Boilers



for Higher Efficiency and Economy

SEE OUR CATALOGUE IN SWEETS

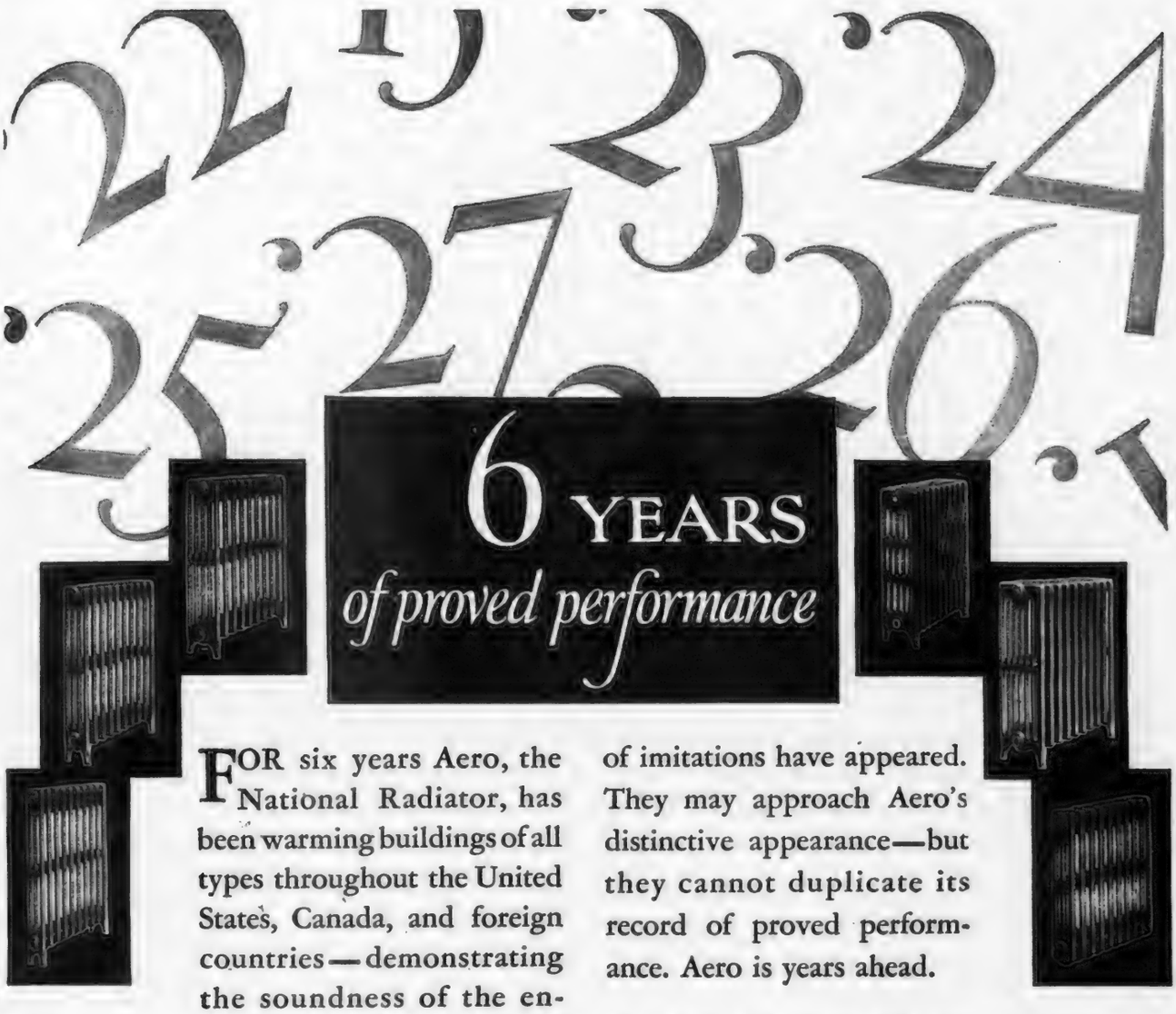
Ask for complete specifications. Write Dept. D-29, giving size and pressure desired. Built in sizes from 29 to 250 H.P. (3500 to 31000 sq. ft. Steam Radiation) for working pressures of 15, 100, 125, and 150 lbs. Built for higher pressures if desired.

That's the way Stanwoods are built—to deliver the utmost in efficiency with the most economical operation. Wherever they have been installed, in whatever type of heating or power service, the results have been the same—complete satisfaction. Low head room requires relatively little or no excavation for installation. Absence of outside brickwork reduces installation costs. Low water line (from 48″ to 75″) is a very valuable characteristic for a heating boiler. Absence of mudlegs, staybolts and crownsheets eliminate costly repairs. The compactness and small size make it ideally suited for heating use for which it is especially built.

THE STANWOOD CORPORATION

Manufacturers also of Horizontal Return Tubular Boilers, Stacks, Breechings, and Tanks

Est. 1891 **Cincinnati, O.**



FOR six years Aero, the National Radiator, has been warming buildings of all types throughout the United States, Canada, and foreign countries — demonstrating the soundness of the engineering principles on which it is constructed, and building an ever increasing group of satisfied customers.

Today Aero is truly "the National Radiator." A host of imitations have appeared. They may approach Aero's distinctive appearance—but they cannot duplicate its record of proved performance. Aero is years ahead.

Sell Aero Radiation, and you sell beauty, warmth, and efficiency. Aero, the National Radiator, retains its place as leader in attractiveness and health-giving comfort.

NATIONAL RADIATOR CORPORATION

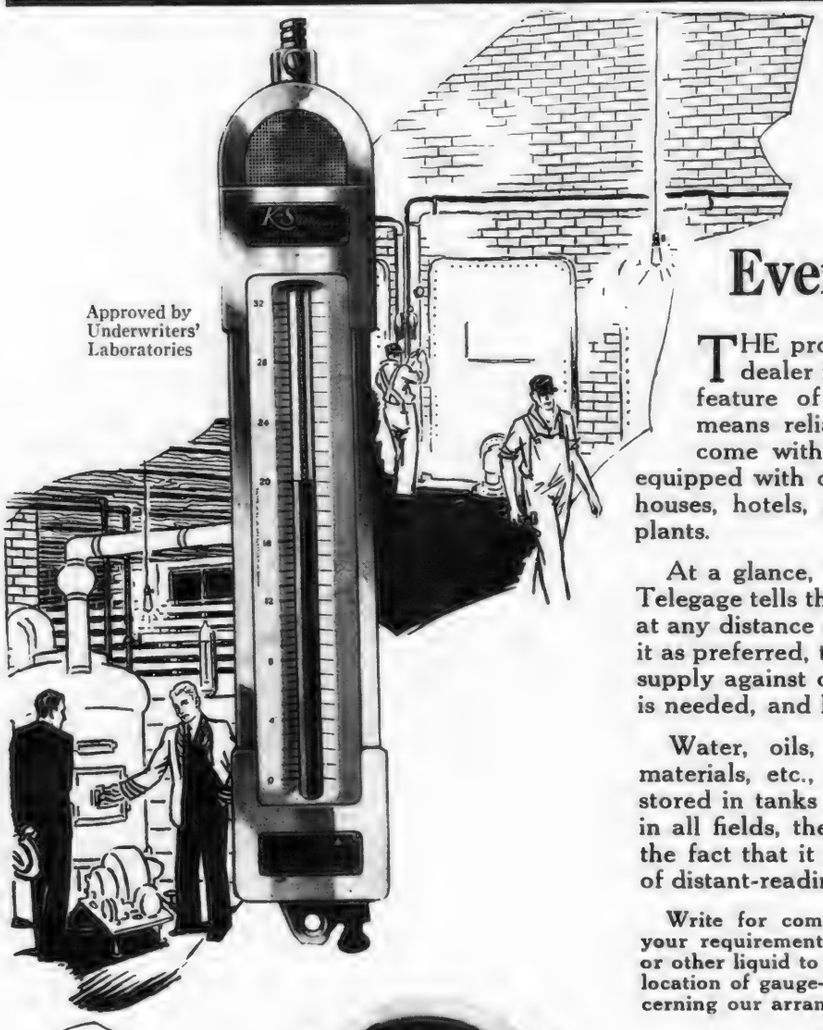
Manufacturer of Radiators and Boilers

Nine Plants devoted to National Service through these Branch Offices and Warehouses:

Baltimore, Md.—2600-2622 Matthews St
Boston, Mass.—93-97 Oliver St.
Buffalo, N. Y.—259-265 Delaware Ave.
Chicago, Ill.—2445 N. Keeler Ave.
Cleveland, Ohio—935 E. 63rd St.
Cincinnati, Ohio—3530-36 Spring Grove Ave.
Indianapolis, Ind.—431 W. Georgia St.
Johnstown, Pa.—221 Central Ave.
Omaha, Neb.—108-112 S. Tenth St.
Milwaukee, Wis.—124-130 Jefferson St.
New York, N. Y.—55 W. 42nd St.
Richmond, Va.—3032 Norfolk St.
Philadelphia, Pa.—121 N. Broad St.
Pittsburgh, Pa.—1509 Arrott Bldg.
Washington, D. C.—2205 Fifth St., N.E.
St. Louis, Mo.—1042 Central Industrial Ave.

AERO THE NATIONAL RADIATOR

THE HYDROSTATIC DISTANT READING GAUGE



Approved by Underwriters' Laboratories

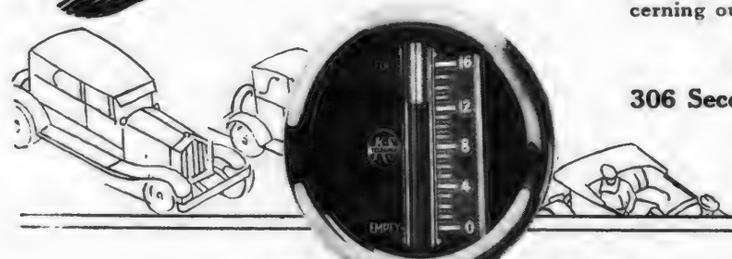
Safety in the Home and in Every Type of Building

THE progressive heating engineer and oil burner dealer is selling *the safety idea* as a fundamental feature of Telegage service. The K-S Telegage means reliable protection against the dangers that come with fuel failure—in every type of building equipped with oil burners—in private homes, apartment houses, hotels, hospitals, public buildings and industrial plants.

At a glance, with convenience and dependability, the Telegage tells the depth of fuel in the storage tank. Placed at any distance from the tank, and either above or below it as preferred, this scientific instrument guards the fuel oil supply against costly errors, showing when a new supply is needed, and how much.

Water, oils, chemicals, gasoline, fuel oil, finishing materials, etc., are a few of the many industrial fluids stored in tanks and guarded by the K-S Telegage. And in all fields, the reliability of the Telegage is assured by the fact that it is a product of the world's largest maker of distant-reading gauges.

Write for complete information, giving a full description of your requirements—the Baume or Specific Gravity of each fuel or other liquid to be measured—the distance from tank to desired location of gauge—and size of tank to be used. Information concerning our arrangement with dealers sent on request.



KING-SEELEY CORPORATION

306 Second Street **Ann Arbor, Michigan**

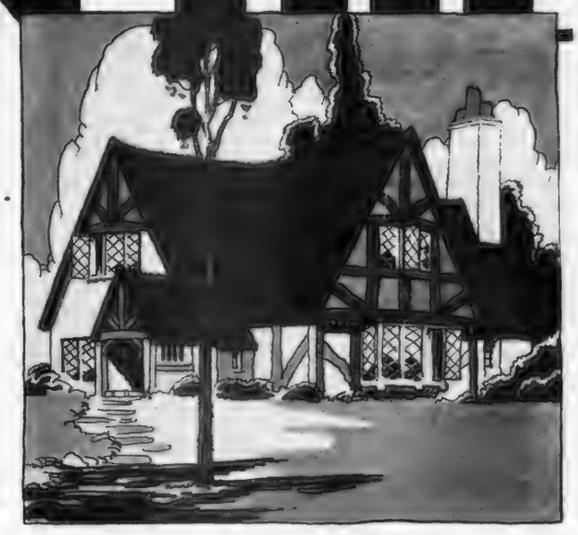
Branch Offices:
New York—44 Murray Street
Chicago—472 Wrigley Building

The K-S Telegage

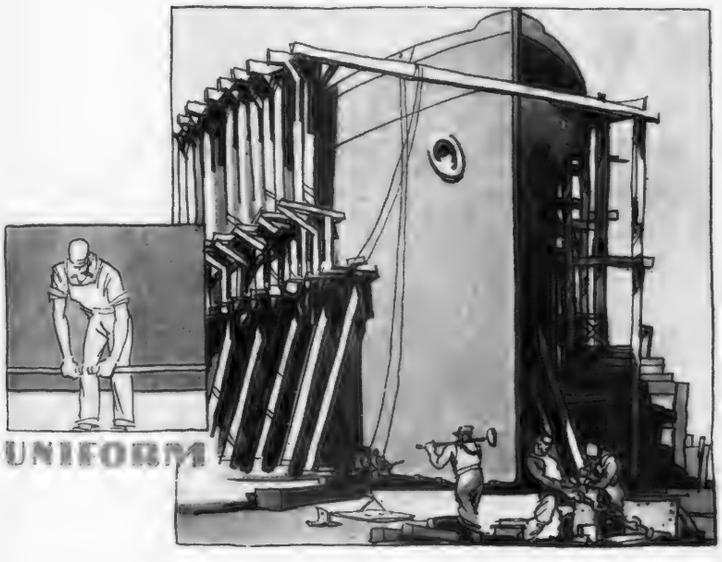
BE CERTAIN WITH THE *K-S TELEGAGE*

Standard factory equipment on three-fourths of all cars selling for $700 or more.

ON THE JOB



"EASY" THREADING



UNIFORM

Since **1828**

ACCURATE

Whenever you require good, dependable pipe, whether it be for a house or a ship, a power plant or what not, think of Etna—the welded steel pipe backed by a century of skilled manufacturing experience.

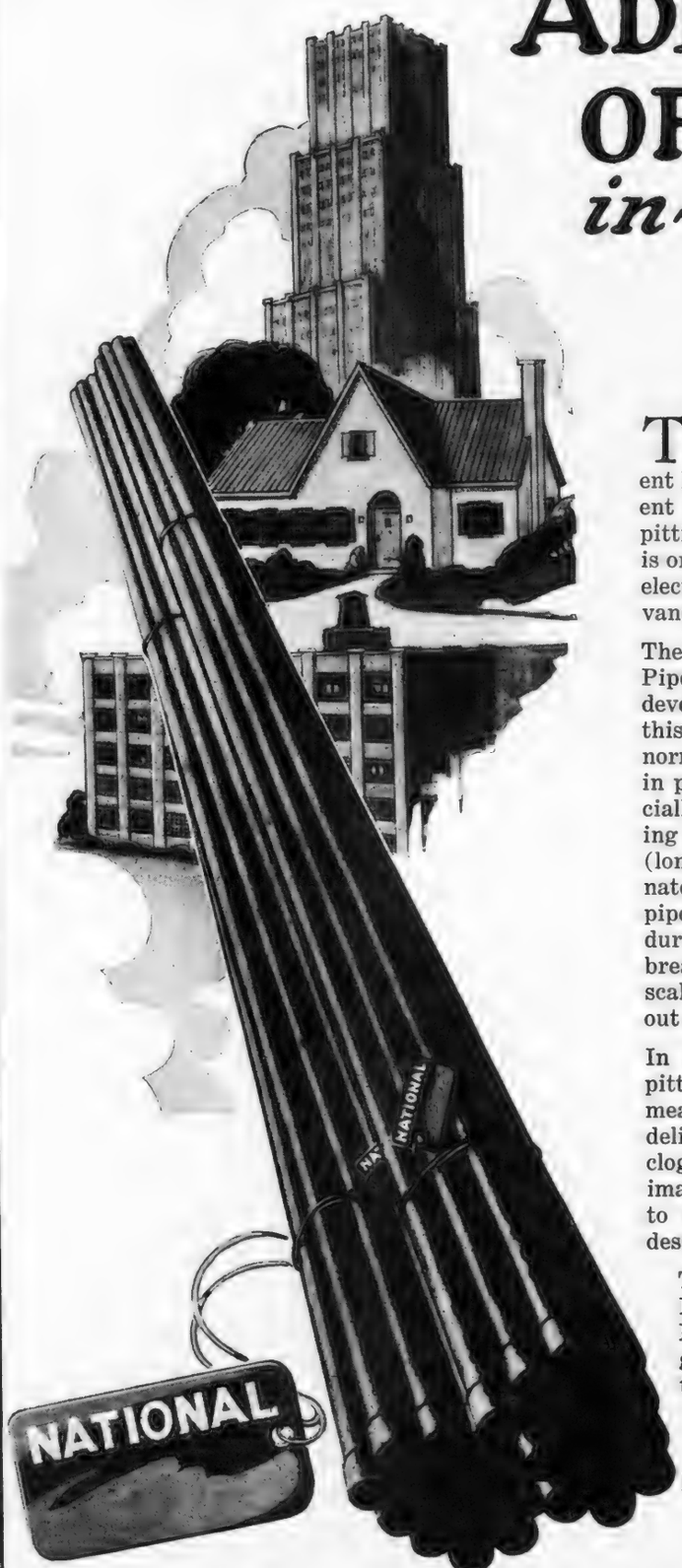
SPANG, CHALFANT & CO., INC.

General Offices: **Clark Building, Pittsburgh, Pa.**

Sales Offices: Chicago, Ill., New York, N.Y., St. Louis, Mo., Pittsburgh, Pa., Tulsa, Okla., Los Angeles, Cal. *Mills:* Etna, Sharpsburg, Ambridge, Pa.

ETNA WELDED STEEL PIPE

ADDED YEARS OF SERVICE *in- skyscraper bungalow and factory*



THE life of pipe in most cases is a matter of its ability to resist some form of corrosion. Different kinds of services are, of course, affected by different types of corrosion. One of the worst types is pitting. It is a proven fact that mill-scale on the pipe is one of the principal causes of pitting. The scale is electronegative to the pipe metal and sets up galvanic action (corrosion).

The Scale Free Process, applied to "NATIONAL" Pipe, butt-weld sizes ½ to 3-inch, was invented and developed by National Tube Company to eliminate this mill-scale, common to all butt-weld pipe in the normal processes of manufacture. It is mechanical in principle and, briefly, consists of a series of specially designed rolls so arranged as to cause a working of the metal forming the pipe walls in opposite (longitudinal and horizontal) directions. This alternate working, or distortion of the hot walls of the pipe causes the mill-scale, which has become brittle during passage of the pipe across a cooling table, to break off and fall from the pipe walls. The loose scale is later removed by compressed air or washed out with water.

In addition to giving added protection against pitting tendencies, "NATIONAL" Scale Free Pipe means a better base for galvanized coatings; full delivery capacity; no damage to valve seats, no clogging of small orifices by loose scale; and approximately 20 per cent greater strength at the weld, due to additional rolling, making the pipe especially desirable for bending, coiling and special uses.

The Scale Free Process, like the Spellerizing Process, is a patented feature, developed by National Tube Company—the details of which are given in Bulletin No. 7. These processes have contributed in making "NATIONAL"—

America's Standard Wrought Pipe

NATIONAL TUBE COMPANY • Pittsburgh, Pa.
Subsidiary of United States Steel Corporation

SCALE FREE PIPE

The CHOICE of the Discriminating

. . . The ten best features for steam or hot water heating are found in the Ross Steel Heating Boiler.

1—Unrestricted circulation.
2—Smokeless.
3—Unusually large direct heating surface.
4—Full length self-cleaning convex crown sheet.
5—Tubes easily cleaned from outside.
6—One large body of water.
7—Indestructible smokeless arch with circulating baffles.
8—Large central flue.
9—All seams electrically arc welded—tubes expanded in heads.
10—Three-pass fire travel.

Write for Catalog—
Ideal for Oil or Gas Burning

The Frost
MANUFACTURING COMPANY
Galesburg, Illinois

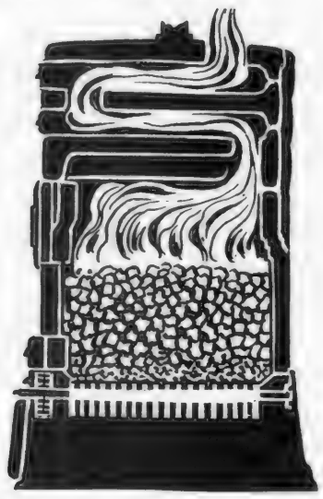
Branches in Most Leading Cities

ROSS STEEL BOILERS

Round Sectional

Burnham Boilers

Nab Dollars For You



Send for Catalog of the whole Burnham Line. There's a Burnham Boiler for every heating purpose.

Who is getting the boiler business you could get? How is he getting it? Haven't you just as much get in you?

Perhaps your trouble is not selling a go-getting boiler. Nab onto the Burnham and see it nab off the dollars for you.

Burnham Boiler Corporation

IRVINGTON, N. Y.

Representatives in all principal cities of the United States and Canada

MAKING IT EASIER TO SELL

A home should be built around the heating plant. Without good heating, it is but an empty shell during many months of the year. Thrush System always satisfies.

BUILDERS of homes have been educated to buy advertised products. Your sales problems are greatly simplified when the public knows Thrush System by name.

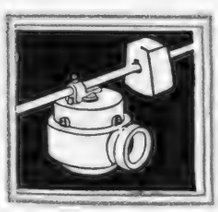
We are telling thousands of builders everywhere that Hot Water Heating is best for their homes and that it is most economically and easily controlled with Thrush System. Cash in on our investment by tying up your business with this big campaign. Push Thrush Equipment for it is the kind of a product you can be proud to sell.

It makes an Automatically Controlled Pressure System from any ordinary gravity hot water job. It will maintain uniform temperatures, reduce fuel consumption, lengthen firing periods and greatly increase the satisfaction which the home owner enjoys. When you install Thrush Equipment, you not only make a nice profit at once, but you make a friend and a booster who will bring you more business.

Nationally Advertised!

In the publications shown above, which are distributed exclusively to individuals planning to build homes and to real estate men and building contractors, Thrush System is being forcefully advertised. A little effort spent on Thrush Equipment in your community will pay big returns Get behind it.

Ask your jobber today



Specify **H. A. THRUSH & COMPANY**
PERU, INDIANA

THRUSH SYSTEM
OF HOT WATER HEATING

H. A. THRUSH & COMPANY. Dept. A. Peru, Indiana
Please send me your catalog and more information about Thrush System.
Also send me the booklet which you are distributing to consumers.

Name _____ ***Address*** _____

My Jobber is _____

Marshall Field

WILL BE HEATED THROUGHOUT *With*

A totally different housing project

THERE is being erected in the City of Chicago a totally different housing project fostered by the Estate of Marshall Field, and known as The Marshall Field Garden Apartment Homes. That its name is well chosen will be apparent when it is learned that a beautifully landscaped park, larger in area than a city block, occupies the center of the space enclosed by the buildings. Chicago is proud of this new non-profit venture in housing—and justly so.

How shall one set out to describe this huge undertaking? Its very scope almost takes one's breath away. It covers an unbroken area of two city blocks, and provides homes for more than six hundred families. Its apartments will rent for an average of but $15 per room per month, and yet will have every convenience that modern science can devise for the comfort and convenience of the tenants. Among these is a Dunham Differential Vacuum Heating System, which will warm every room uniformly and comfortably.

The Marshall Field Garden Apartment Homes occupy a site on Chicago's Near North Side selected by housing experts after a most careful survey of the city's available locations. Each room in each building will have outside light and air. The rooms are unusually large. Kitchens are fully equipped with cabinets, gas ranges, mechanical refrigerators, combination sinks and wash tubs, and dumb waiters. All buildings have concrete base soundproof floors, and are fireproof throughout.

A park, a playground and an indoor playroom for the children to romp in, a first aid room for the proper care of their hurts and bruises, a rest room for tired mothers, an auditorium for meetings and parties, a music room, and glass enclosed sun-porches on the roof of each building, are some of the advantages in store for the lucky tenants of this unique project. And the entire cost of more than five millions of dollars is destined to earn a return of but 5% on the invested capital.

Where else in the world will you find anything quite like these new Marshall Field Garden Apartment Homes? Do you wonder that Chicagoans look upon this project with pardonable pride?

Over eighty sales offices in the United States, Canada and the United Kingdom bring Dunham Heating Service as close to you as your telephone. Consult your telephone directory for the address of our office in your city. An engineer will counsel with you on any project.

C. A. DUNHAM CO.

Garden APARTMENT Homes

The Dunham Differential Vacuum Heating System

U.S. Patent No. 1644114. Additional patents in the United States, Canada and Foreign Countries now pending.

A totally different heating system

A SOLUTION of the housing problem for so many hundreds of families such as the new Marshall Field Garden Apartment Homes provides, without a solution of the heating problem upon which largely depends the health, comfort and physical well being of the tenants, would have been a short-sighted policy. And so you will find that the Trustees of the Marshall Field Estate wisely provided a Dunham Differential Vacuum Heating System as the very finest heating equipment their untiring research had revealed.

Steam will be generated under high pressures, for operating certain mechanical equipment, in a central boiler plant which will be entirely separated from all apartments and located about a block away. A medium pressure steam main will run in a tunnel from the boiler house to the building line where it will divide and run in both directions completely surrounding the ten buildings.

A take-off is made to each building where the main pressure is reduced to two pounds, the maximum required to heat the buildings in the most severe weather. The Dunham Control Valves then reduce this steam to the desired vacuum required to heat the apartments under the prevailing weather conditions. The control valves are adjustable from the boiler room, so that the engineer has control over each building at all times.

This sub-atmospheric steam, temperate as a tropic breeze, never too hot, yet always of sufficient warmth to keep every room at precisely the right temperature for good health and solid comfort, is distributed in each building by basement mains feeding upward to radiators on all floors.

It will not only provide a maximum of healthful, comforting heat, but will effectively prevent the overheating of any room or building, and greatly reduce the ills due to excessively high temperatures, too-dry air which has been robbed of its proper humidity, and chill drafts caused by windows opened to cool off overheated living quarters.

The degree of vacuum carried in the distributing system will determine the radiator temperature and the amount of heat given off to the room. This vacuum is under the control of the operating engineer in the boiler-room and he is thus able to control the temperature in all apartments.

It is significant that the heating of this internationally famous housing project was entrusted to the Dunham Differential Vacuum Heating System, and is further proof of the demonstrated comfort, economy and satisfaction of this system of heating following its installation in approximately 500 leading buildings since its announcement two years ago.

DUNHAM BLDG. 450 East Ohio Street CHICAGO

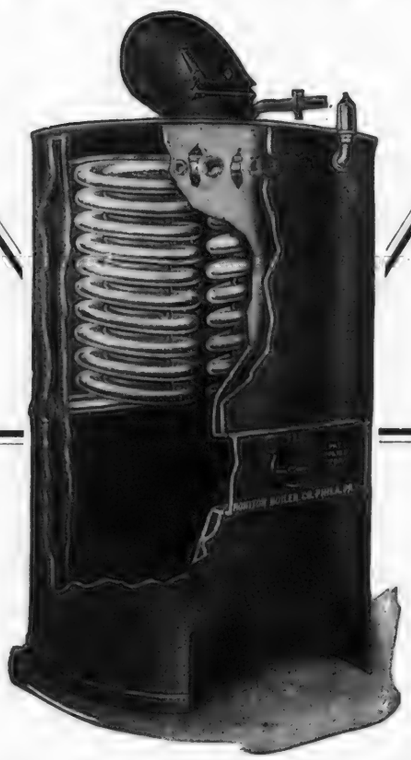
MARSHALL FIELD GARDEN APARTMENT HOMES

Architect: Andrew J. Thomas, New York
Associate Architects: Graham, Anderson, Probst & White, Chicago
Consulting Engineer: Sullivan A. S. Patorno, New York
Chief Engineer of Marshall Field Estate: Charles J. Lehn
Heating Contractor: Charles E. Evans & Co., Chicago
General Contractor: O. W. Rosenthal-Cornell Co., Chicago

COIL

STEEL HEATING BOILERS AND WATER HEATERS

FOR OIL BURNING



The application of the Coil Steel Boiler to oil heating has solved for many a contractor the problem of finding a boiler versatile enough to take care of this advanced method of heating.

These men have found that Coil Boilers present a much greater percentage of heating surface to the direct radiant heat and as a natural consequence effect an economy almost impossible to obtain under any other method.

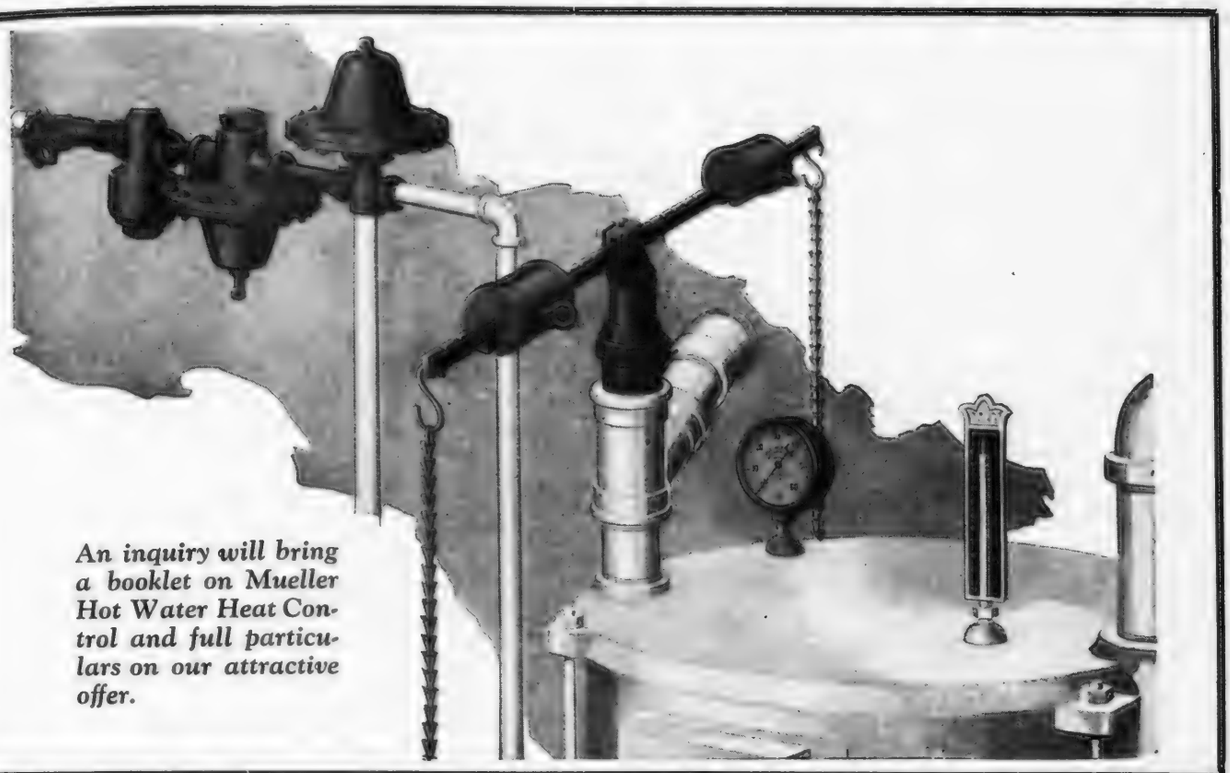
Coil Boilers are good will builders as well as money makers.

Let us give you complete details.

WRITE FOR CATALOGUE

MONITOR BOILER COMPANY

1505 Race Street :: :: Philadelphia, Pa.



An inquiry will bring a booklet on Mueller Hot Water Heat Control and full particulars on our attractive offer.

Three conditions that build *profitable* business

THE Mueller Automatic Heat Control System talks to the heating contractor in terms he understands. It satisfactorily meets the *three conditions that build profitable business*—a good margin of profit—costs less and is easier to install—and satisfies every customer with lasting, dependable service.

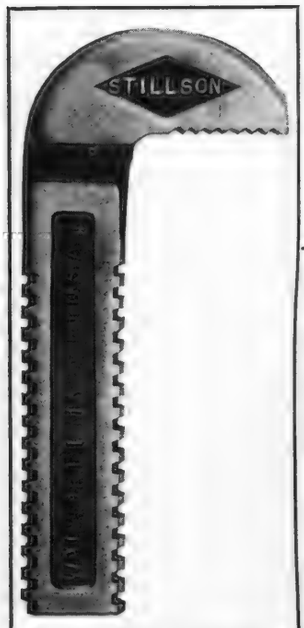
Mueller Automatic Heat Control Systems are easily installed on either old or new jobs. They require practically no attention and effort on the customer's part and give 100 per cent automatic heat control.

MUELLER CO. (Established 1857) Decatur, Ill.
Branches: New York, Dallas, San Francisco, Los Angeles
Canadian Factory: MUELLER, Limited, Sarnia

MUELLER

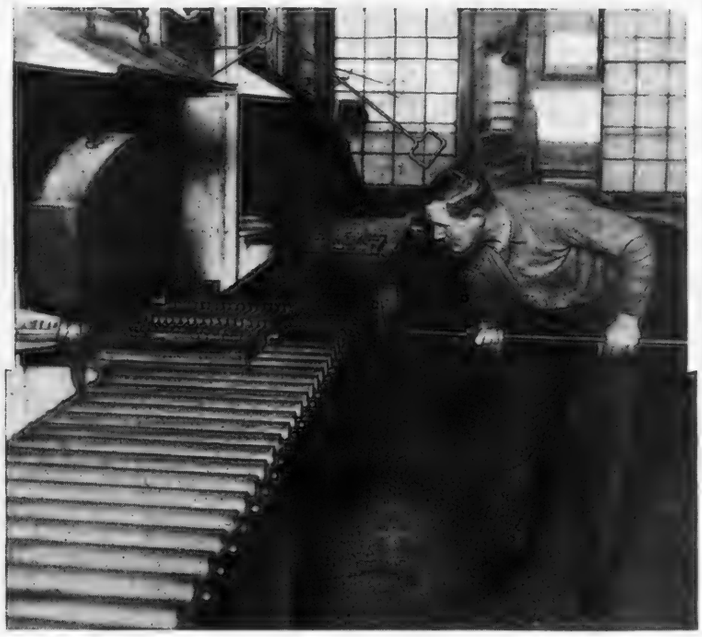
AUTOMATIC HEAT CONTROL SYSTEM

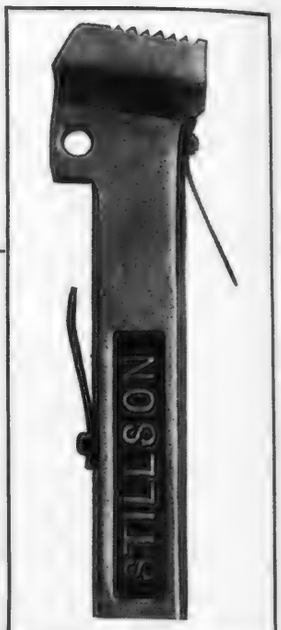
JAW AND BAR ARE MADE TOUGHER AND STRONGER BY PYROCHRON PROCESS



THE JAW

Heat treatment makes the jaw 50% stronger than even the old Walworth Stillson and of uniform quality.





THE BAR

This bar will take a load far in excess of that claimed for any other pipe wrench. Its other end is the famous red handle.

THE Pyrochron treatment of the Walworth Master Stillson looks like putting a pan of loaves into a bake oven. The baking, scientifically controlled as to temperature and time, imparts that unequalled hardness and toughness to the Master Stillson that so distinguish the "world's most famous tool."

The heat treating process results, literally, in baking brittleness *out* and putting toughness *into* the jaw and bar, so that these working parts have a tensile strength of 160,000 pounds per square inch. Which means greater strength, longer life and less trouble to the man who uses the Master Stillson.

The Walworth Parmelee

Similar to the Master Stillson in the qualities of strength, endurance and toughness is the Walworth Parmelee, the ingenious wrench for use on brass pipe and smooth rods. The Parmelee takes hold like a human hand but with the grip of a giant. The working parts of the Parmelee undergo the same Pyrochron heat treatment that is given to the Master Stillson.

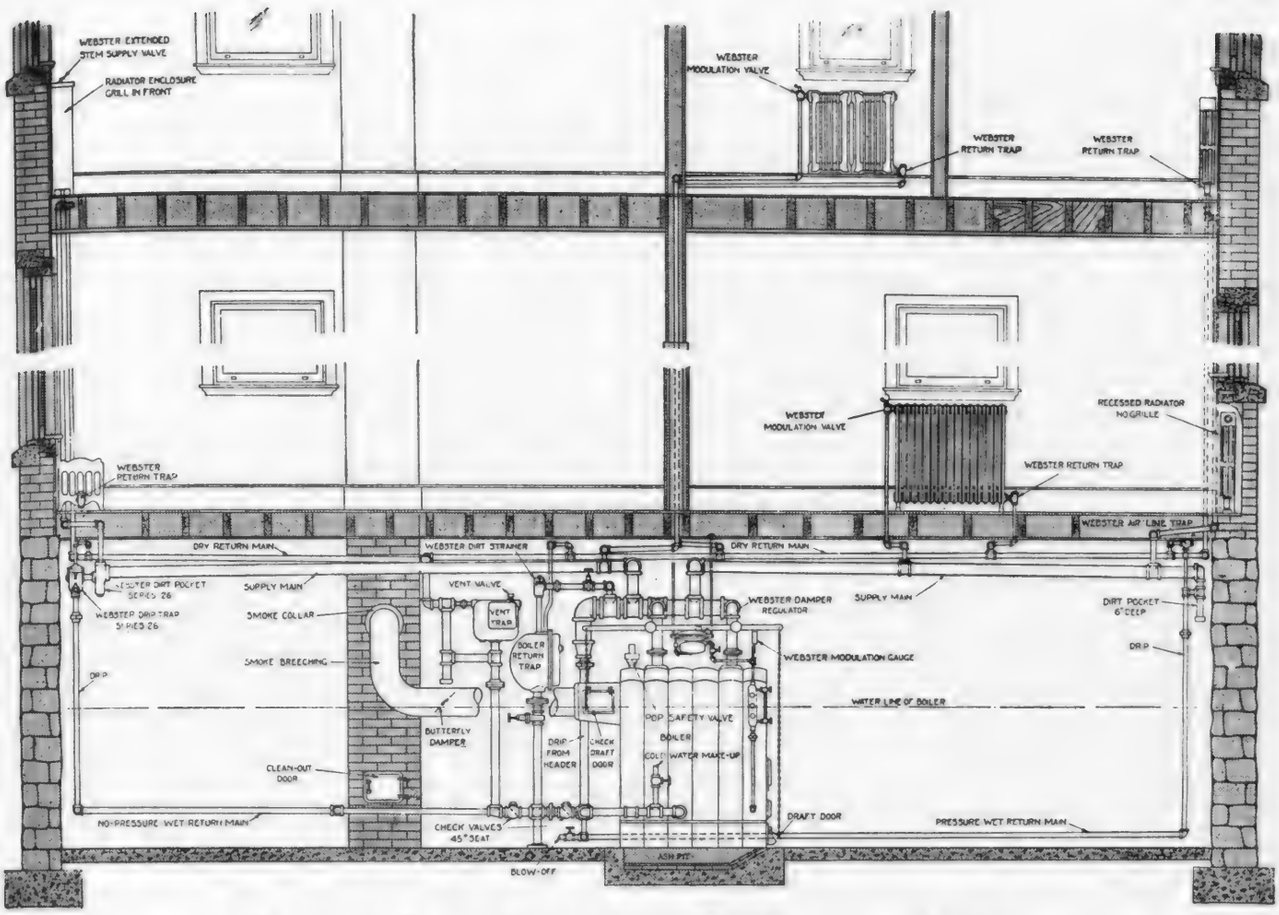
WALWORTH

Walworth Company, General Sales Offices: 51 East 42nd St., New York
Plants at Boston, Mass.; Kewanee, Ill.; Greensburg, Pa., and Attalla, Ala.

Distributors in Principal Cities of the World

Walworth International Co., 11 Broadway, New York, Foreign Representative
Walworth Company, Limited, 10 Cathcart Street, Montreal, P. Q.

MASTER TRADE MARK STILLSON REGISTERED U.S. PATENT OFFICE **STILLSON**



Consider the possibilities of the Webster Type "R" System of Steam Heating

OPERATING principles of the Webster Type "R" System illustrated here are simple and quickly understood. Steam is produced in either a cast iron or steel boiler, the draft of which is controlled by a sensitive Webster Damper Regulator. Entrance of the steam to the radiators is controlled by Webster Modulation Valves, wherever graduated control is desired . . . otherwise by Webster Sylphon Packless Valves.

Webster Return Traps attached to radiator outlets hold the steam in the radiators, but permit passage of water and air back to the Vent Trap and Boiler Return Trap. The Vent Trap permits air to escape from the system, but prevents its return.

The Webster Boiler Return Trap assures prompt return of all condensation to the boiler automatically regardless of pressure (up to a maximum of 15 pounds). The arrangement of the Boiler Return Trap with the Vent Trap assures safety. Reliable—SAFE—does not require skilled operation—free from after-installation service calls. Here is a system you can install with complete confidence in many types of buildings requiring 500 to 15,000 sq. ft. of radiation. The coupon will bring you complete description of system and apparatus.

- since 1888 **Webster** *Systems of Steam Heating*

The Webster Steam Heating Specialist in your vicinity can probably help you in developing *preferred* business with Webster Type "R" Systems. Get in touch with him.

WARREN WEBSTER & COMPANY
CAMDEN, NEW JERSEY

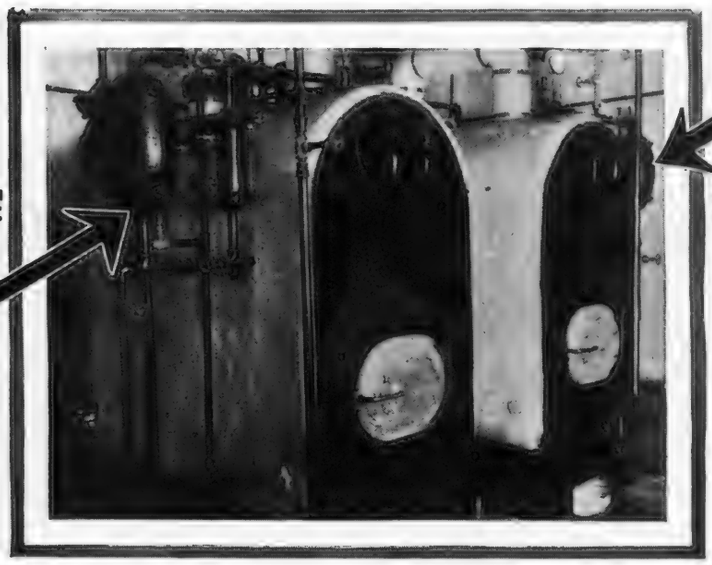
Pioneers of the Vacuum System of Steam Heating
52 U. S. Branch Offices—*In Canada, Darling Bros., Ltd., Montreal*

MORE THAN 46,000 INSTALLATIONS IN AMERICA'S FINER BUILDINGS

WARREN WEBSTER & COMPANY, Camden, New Jersey.

Please mail Bulletin B-600, describing the Webster Type "R" System of Steam Heating to

Name..... Street..... City..... H&V2-29



Two McDonnell & Miller Self Cleaning Feeders in the National Education Association Building, Washington, D. C.

Now thousands have tested *"quality boiler protection" for you!*

RIGHT now—at the peak of the heating season—thousands of Self-Cleaning McDonnell & Miller Boiler Feeders are hanging up a record in boiler protection that has never before been equalled. Praise everywhere; failures nowhere! It is a record that you cannot afford to overlook.

Even at the time this revolutionary feeder was developed, thousands of engineers had recognized the *principle* of the duplex feeder. They realized that of all safety devices, none is so important as a device to keep *the boiler water line where it belongs*. But thinking engineers and contractors also stressed the fact that of all devices, this safety device should be the *most dependable*.

Our Answer—the Self-Cleaning Feeder

Our answer to this demand was a revolutionary departure from accepted practice—rotary self-grinding valves to insure self-cleaning—larger capacity to protect against broken circuits to the condensation pump unit—adjustable water levels and differentials between valves to save the steam fitter's time—unheard of refinement in every detail.

Naturally it costs more to build such a feeder, and at the outset there was the usual resistance to a higher price. But, as ever, the thought of price quickly yielded to the proof of value.

Guaranteed for a full year

So flawless has been the service of this feeder that it is now guaranteed to give perfect satisfaction for a full year. This guaranty is our pledge of confidence in the feeder. The record of the feeder is your assurance that we will not have to make the guaranty good.

Your copy of the informative catalog is as close as the coupon below.

The "Rolls-Royce" of Feeders—

When you look at the McDonnell & Miller Feeder you see a totally new standard of feeder design and construction. It has only one float—only one moving unit. The feed water does not enter the feed chamber but is fed with full city pressure behind it, exactly as if the feed-valve were manually operated. The fewer parts are made with machine-tool precision. Each feeder is factory tested under actual operating conditions before shipment. It is built for continuous unfailing service—and gives it.

McDONNELL & MILLER
710 Wrigley Bldg., Chicago

McDONNELL & MILLER
SELF-CLEANING
Duplex Feeder
"Doing one thing well"

McDONNELL & MILLER,
710 Wrigley Bldg., Chicago
Please send a copy of your booklet to:
Firm
Individual
Street and Number
City and State
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ANOTHER NOTABLE INSTALLATION

The New York Central Building occupies an entire block from Vanderbilt Ave. to Depew Pl. and from 45th to 46th Sts. It is 35 stories high. Equipped with over 3000 B & B Multiflex Valves and Multiflex Traps.

WARREN & WETMORE
Architects and Engineers
JAMES STEWART & CO.,
General Contractors
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Heating Contractors

The efficiency and durability of B & B Multiflex Traps, and Multiflex Modulation Valves have resulted in their general adoption by architects, engineers and contractors, for all types of buildings, large and small.

THE BISHOP & BABCOCK SALES COMPANY
CLEVELAND, OHIO
Offices in principal cities

Sectional View of Special Multiflex Modulation Valve

Sectional View No. 6 Multiflex Trap

BISHOP & BABCOCK

TEMPERATURE REGULATION
HEATING SPECIALTIES VENTILATING EQUIPMENT

A New Source of Income for You

—without the need for investment on your part

WORKING arrangements for the sale of Electrol Automatic Oil Burners in your locality can be made with the local Electrol dealer.

It is an attractive proposition which works for your mutual benefit and profit—without need for investment on your part.

The reputation for exceptional performance which Electrol enjoys locally wherever it is sold is a distinct advantage in such an arrangement. Very often you will find that the home builder's preference is for Electrol, with the sale half made before you make your recommendations.

Electrol is Electrically Controlled and Electrically Operated . . . Quiet . . . Economical . . . and Entirely Automatic. There is no gas pilot light. No need for one. A small, low-power-consumption motor furnishes the power. An electric thermostat holds the temperature uniform. And over all, *The Master Control* stands watch night and day, timing the ignition, regulating the flow of oil, governing combustion and providing a never-failing, entirely automatic check on every operation.

There is an Electrol for every job. Three sizes, Models TJ, T and TD, ranging in capacity from 200 to 8,000 square feet of steam radiation, including piping and risers or equivalent.

You will find the Electrol dealer candid and conscientious in his statements covering the possibilities of Electrol for each job. He does not overstate its possibilities. He does not have to.

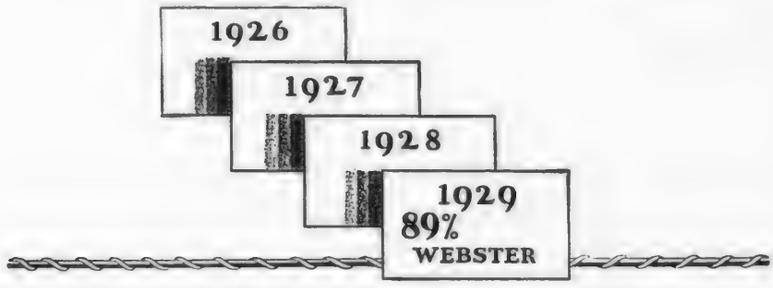
The local Electrol Sales and Service Representative will be glad to explain the working arrangements which will provide a highly profitable source of additional income for you. Write us for his name and address—and for Electrol literature.

ELECTROL INCORPORATED
177 Dorcas St., St. Louis, U. S. A.

ELECTROL

The OIL BURNER with *The Master Control*

Listed as standard by the Underwriters' Laboratories, and bears their label



. . . by sheer merit alone the Webster Ignition Transformer has in four short years become the most widely used oil burner ignition unit in the field!

The Webster Sales and Engineering Departments will gladly explain the reasons for this wide acceptance.

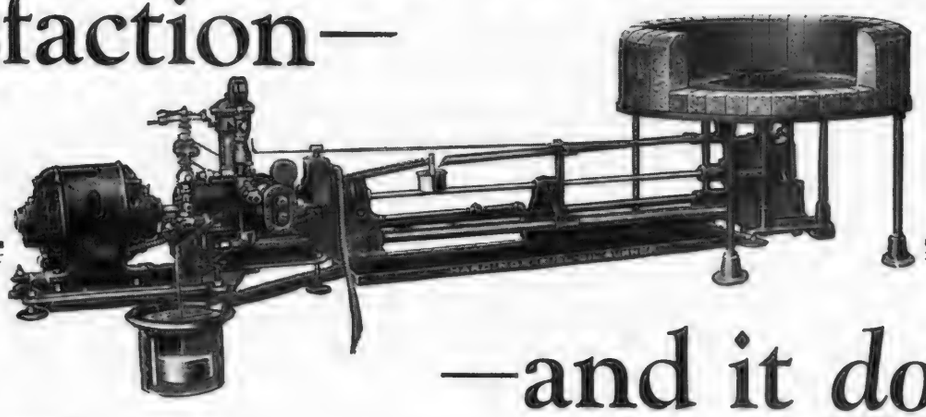
The Webster Ignition Transformer can be furnished with either single or double high tension terminals, for a variety of voltages and frequencies.

Webster

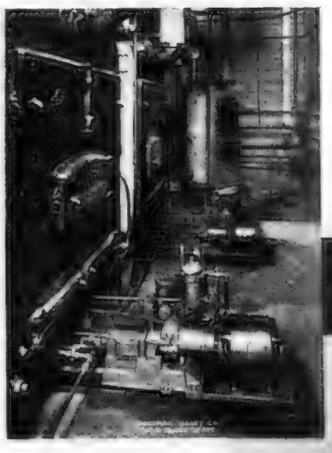
W *Ignition Transformer*

WEBSTER ELECTRIC CO., RACINE, WISCONSIN

Designed to give permanent satisfaction—

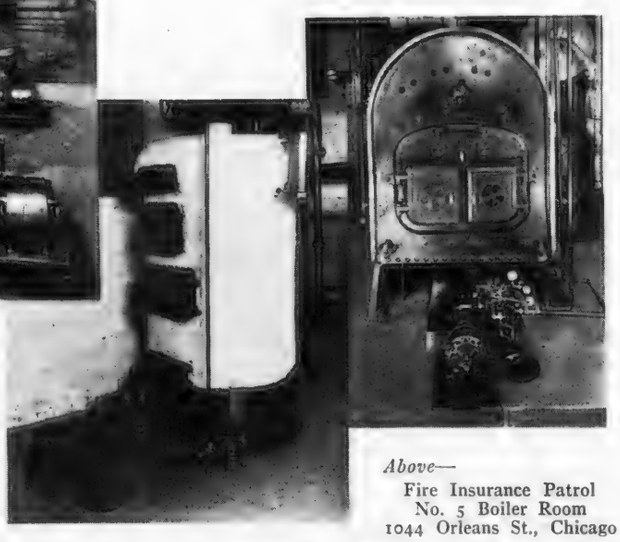


—and it *does!*



Above—
Bowman Dairy Co.
4310 Kenneth Avenue
Chicago

Right—
George Smart Residence
1315 Elmdale Ave.,
Chicago



Above—
Fire Insurance Patrol
No. 5 Boiler Room
1044 Orleans St., Chicago

Hardinge installations, whether large or small, domestic or industrial, give perfect service and satisfaction year after year.

Precision-built in two distinct models—both Domestic and Industrial—in 12 different sizes and combinations, enable specific treatment for any heating problem.

Dependable, economical, quiet, carefree—you can safely specify Hardinge Fuel Oil Heat for any building "from bungalow to skyscraper."

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Manufacturers of Precision-Built Machines for 38 Years

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150 Pounds Pressure CRANE VALVES 2500 Pounds Pressure

COMPLETE ASSURANCE
OF SAFETY
AND SATISFACTION
COSTS SO LITTLE

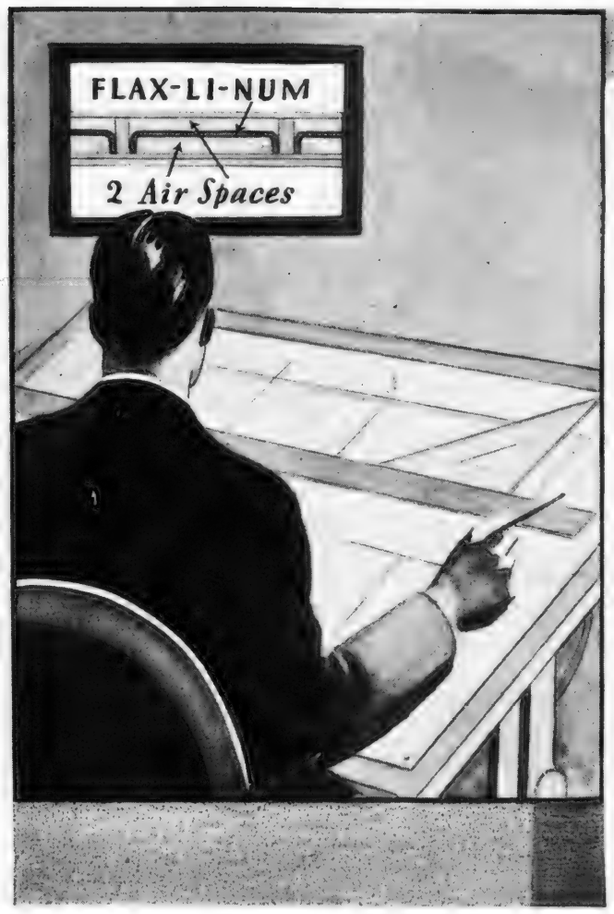
No. 438 Standard Brass Gate Valve for
125 pounds Steam Working Pressure

Occasionally Crane Co.'s prices may seem a little higher, but consider this: The number 438 Standard Brass Gate Valve pictured to the right and recommended for steam working pressures up to 125 pounds is stronger than many valves of the same type rated at 150 pounds. In other words you are receiving 25% more strength when you buy this Crane valve than you would get by purchasing certain other brands.

Perhaps Crane Co.'s ratings seem low. But 74 years of research and practical experience have definitely proved the Crane theory that it is more economical to rate materials conservatively. The extra strength that Crane Co. gives is a guaranty of efficiency, of lowered operating costs, of minimized replacements, and a security against the appalling waste of time and money that forms the wake of every accident.

CRANE

GENERAL OFFICES: CRANE BUILDING, 836 S. MICHIGAN AVENUE, CHICAGO
NEW YORK OFFICE: 23 W. 44TH STREET
Branches and Sales Offices in One Hundred and Eighty Cities



you can't side-step A SCIENTIFIC FACT

"THE insulating value of an ordinary air space more than about one inch in width is equivalent to about ¼ inch of insulating material. The addition of a half-inch layer of insulation in the middle of the air space in a frame wall is, therefore, the equivalent of adding about a ¾ inch layer at some other place in the wall."

In these terms . . positive and unquestionable in their authority . . the U. S. Bureau of Standards Letter Circular No. 227 sets forth the scientific principle upon which the FLAX-LI-NUM two-air-space method of insulation is based. FLAX-LI-NUM is installed between the studs to form two air spaces in the wall . . it increases its own insulating value 50% after it is in place.

These facts cannot be side-stepped . . . . Greater efficiency . . . . greater home comfort . . . and greater fuel economy are the inevitable results of the FLAX-LI-NUM two-air-space method.

May we send you a valuable manual containing full specifications and the transmission coefficients of the various types of walls and roofs?

FLAX-LI-NUM INSULATING COMPANY H V-2
St. Paul, Minnesota

Send me complete information about Flax-li-num. Also facts about the 2-air-space method.

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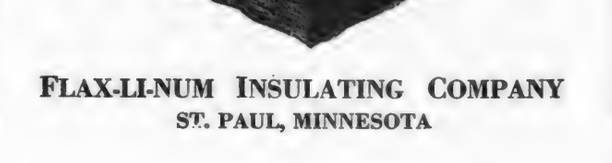
A CORRECT BUILDING INSULATION AND SOUND CONTROL MATERIAL



FLAX-LI-NUM INSULATING COMPANY
ST. PAUL, MINNESOTA

Who uses BADGER Self-Equalizing Expansion Joints?

The following prominent public utility companies, manufacturers and institutions number among the many users.

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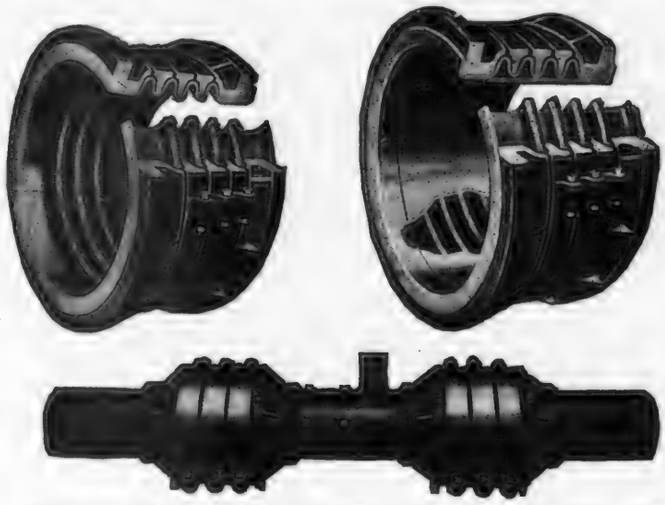
Consumers Central Heating Co., Tacoma, Wash.
Brooklyn Edison Co., Brooklyn, N. Y.
Public Service Gas Co., Newark, N. J.
Detroit Edison Co., Detroit, Mich.
Ohio Edison Co., Springfield, Ohio
Illinois Power & Light Co., Chicago, Ill.
Georgia Power Co., Atlanta, Ga.
Consumers Power Co., Jackson, Mich.
Westerlin Campbell Co., Chicago, Ill.
M. H. Treadwell Co., New York, N. Y.
M. W. Kellogg Co., New York, N. Y.
Gulf Refining Co., Pittsburgh, Pa.
Ford Motor Co., Detroit, Mich.
Hudson Motor Co., Detroit, Mich.
The Studebaker Corp., Detroit, Mich.
Stone & Webster, Inc., Boston, Mass.
Dwight P. Robinson & Co., Inc., New York, N. Y.
Sanderson & Porter, New York, N. Y.
Carnegie Steel Co., Pittsburgh, Pa.
American Sugar Refining Co., Brooklyn, N. Y.
Dartmouth College, Hanover, N. H.
General Electric Co., Schenectady, N. Y.

Badger Self-Equalizing Expansion Joints have no stuffing boxes and require no packing. They will not leak, stick or distort in service.



For saturated steam—single unit Badger Self-Equalizing Expansion Joint.

For superheated steam—single unit Badger Self-Equalizing Expansion Joint, with telescoping monel metal sleeve.

Double unit Badger Self-Equalizing Expansion Joint with service outlet, and open pipe ends for installation in welded pipe line.

BADGER ENGINEERING SERVICE

Badger engineers are designers, manufacturers and installation experts for the following and kindred power plant products: Pipe Bends, Chemical Apparatus, Copper and Sheet Metal Work, Copper Boilers.

E. B. BADGER & SONS CO.

75 Pitts Street, BOSTON, MASS.

New York: 271 Madison Ave. Chicago: 2831 South Parkway

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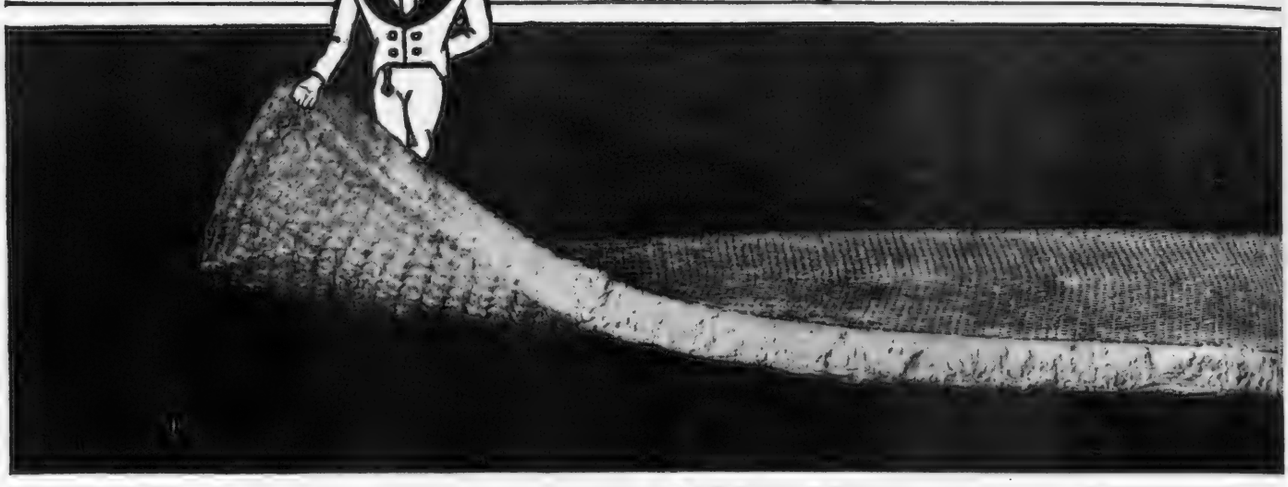
BADGER EXPANSION JOINTS

ESTABLISHED 1841 · WEATHER VANE ON FANEUIL HALL · E. B. BADGER & SONS COMPANY · TRADE MARK

Mr. B.T.U. Says "Consider the Importance of



Flexibility
Permanency ~
Efficiency and Economy
in choosing Insulation to meet your needs"

These are important factors in the obtaining of Economical Efficiency — and BANROC has them all.

Flexible; conforms to all irregularities of the surface insulated, and absorbs expansion and contraction without cracking or opening up at the seams. Permanent as the rock from which it is made, will not settle, disintegrate or deteriorate

Highest efficiency given any commercial insulating material by the U. S. Bureau of Standards.

The conductivity rating of the U. S. Bureau of Standards marks BANROC as a leader in insulation efficiency.

Costs less to buy and less to apply.

BANROC Products meet every insulation requirement up to 1200°F.

BANROC Engineers are trained to solve every insulating problem within that temperature range. There's one near you; call him in to help you solve yours.

This service costs you nothing, and may save you a lot of money.

Consult the Phone Directory in the following Cities for a BANROC ENGINEER

BOSTON	TOLEDO
PITTSBURGH	HOUSTON
CHICAGO	DENVER
NEW YORK	DETROIT
CLEVELAND	TULSA
ST LOUIS	PHILADELPHIA
BUFFALO	LOS ANGELES
NEWARK	SAN FRANCISCO

BANNER ROCK PRODUCTS COMPANY, ALEXANDRIA, INDIANA

BANROC INSULATION

ORIGINATORS · OF · ROCK · WOOL · PRODUCTS

At Your Service
. . . . . on any Heating Job

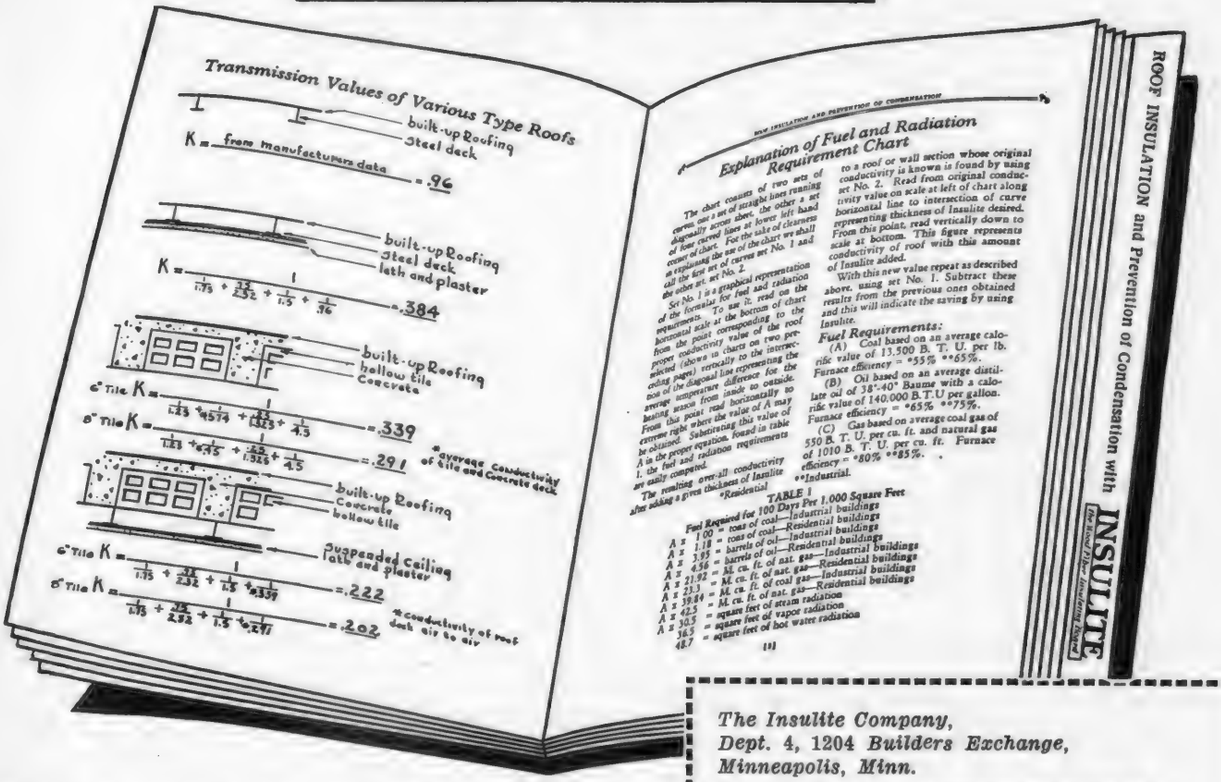
Is this portfolio on "Roof Insulation and Prevention of Condensation" in your files? If you have not received a copy, please write for it to-day. It contains accurate charts and much helpful data on proper insulation and the prevention of moisture condensation—all being an essential part of any heating job.

INSULITE roof insulation has helped many heating engineers. The portfolio is a constant source of information, and our engineering department will be glad to give assistance in connection with special problems.

INSULITE roof insulation comes in one-inch and one-half-inch thicknesses. Has great strength, great heat-resisting value, is easy to handle and work with. No waste through breakage. Not injured by exposure.

Write for the portfolio or ask for any specific help

INSULITE
the Wood-Fiber Insulating Board



THE INSULITE COMPANY
1204 Builders Exchange, Dept. 4
MINNEAPOLIS MINNESOTA

The Insulite Company,
Dept. 4, 1204 Builders Exchange,
Minneapolis, Minn.

Please send your Insulation portfolio to

Name.....

Address.....

City.....*State*.....

Celotex Roof Insulation Board being applied to the roof of the National Plate Glass Company, Ottawa, Ill.

Retard heat losses . . . Improve ventilation

with Celotex Roof Insulation Board

You obtain better results from heating plants under roofs insulated with Celotex Roof Insulation Board.

Celotex retards heat leakage through roofs, thus lowering winter fuel consumption.

It protects top floor rooms against extremes of heat and cold, and provides greater comfort for those inside.

It assists in securing good ventilation by reducing convection current drafts due to cold roof surfaces and by resisting sudden changes in temperature.

Celotex is made from tough cane fibre, firmly interlaced and felted into strong, rigid boards.

The thermal conductivity of Celotex is remarkably low—0.33 B.t.u. per hour, per square foot, per degree Fahrenheit, per inch of thickness. Celotex Roof Insulation comes in boards 2′ x 5′, approximately ½″ thick. Applied in two or more layers, it effectively insulates any type of roof.

Celotex also helps to reduce ceiling condensation, and lessens the danger of expansion and contraction of roof decks.

Both warm and cold air ducts can be effectively insulated with Celotex Industrial Insulation Board. More efficient than other air duct insulators, Celotex costs less and is easier to apply.

Safeguard your reputation as a heating engineer by insisting that your jobs be insulated with Celotex. Your clients will appreciate the fuel saving and new year 'round comfort this insulation brings.

THE CELOTEX COMPANY, Chicago, Ill.
Mills: New Orleans, Louisiana
Branch Sales Offices in many principal cities (See telephone books for addresses)
In Canada: Alexander Murray & Co., Ltd., Montreal.

The word CELOTEX (Reg. U. S. Pat. Off.) is the trademark of and indicates manufacture by The Celotex Company, Chicago, Ill.

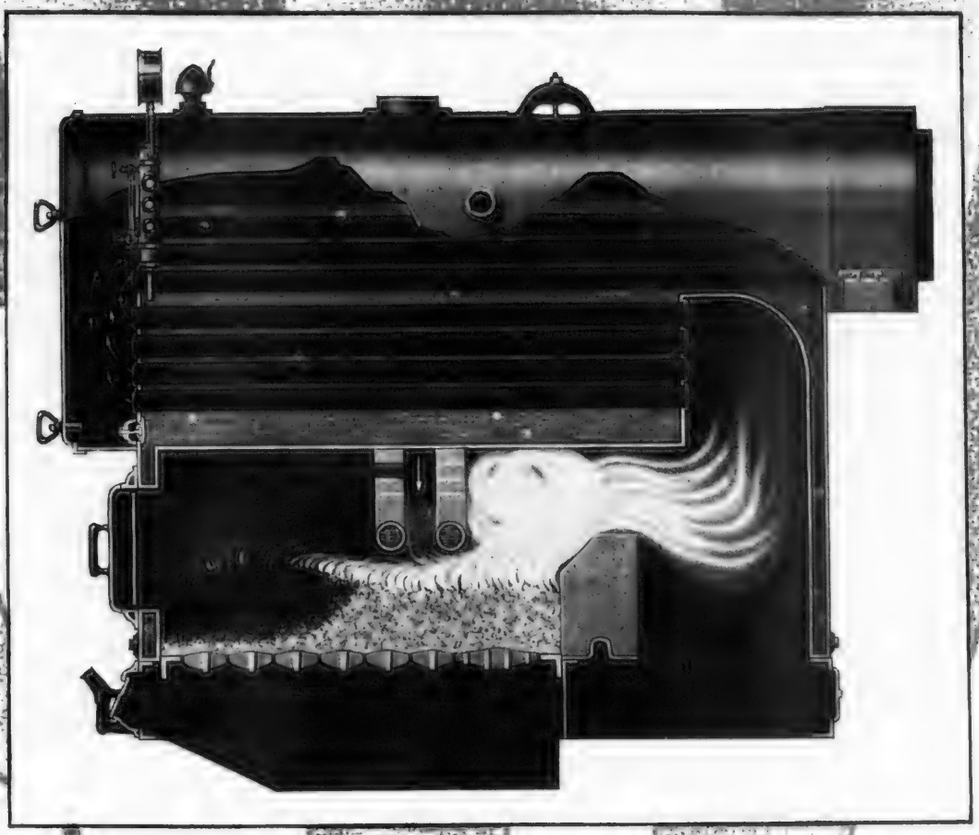
CELOTEX BRAND ROOF INSULATION

a NEW Smokeless Boiler!

by

HEGGIE-SIMPLEX

FOR DETAILS SEE NEXT PAGE



Heat—but No Smoke from Soft Coal

THE *new* Heggie-Simplex Smokeless Boiler burns the cheaper grades of soft coal efficiently, economically and in compliance with the most drastic smoke ordinances — without requiring especially trained firemen.

A special "carbureting chamber", made of *refractories*, introduces heated air over the fire (see arrow). It supplies the additional oxygen necessary to burn bituminous coal smokelessly, but which cannot be drawn through the fuel bed alone.

Intake doors on both sides of the boiler admit air into the "carbureting chamber". There it mixes with volatiles arising from the fresh fuel and is thoroughly heated by the *refractory* walls before passing down onto the fire. This inflammable mixture unites with the soot laden gases streaming under the chamber and is swept against the rear bridge wall. The turbulent whirlpool of flame which results, completely mixes and ignites all combustibles. The auxiliary chamber beyond the bridge wall provides the room essential to complete combustion. Thus, regardless of the amount fired, only smoke-free gases enter the flues.

For descriptive folder write Heggie-Simplex Boiler Company, Joliet, Ill. Representatives in principal cities — telephone and address listed under "Heggie-Simplex Boilers."

HEGGIE-SIMPLEX

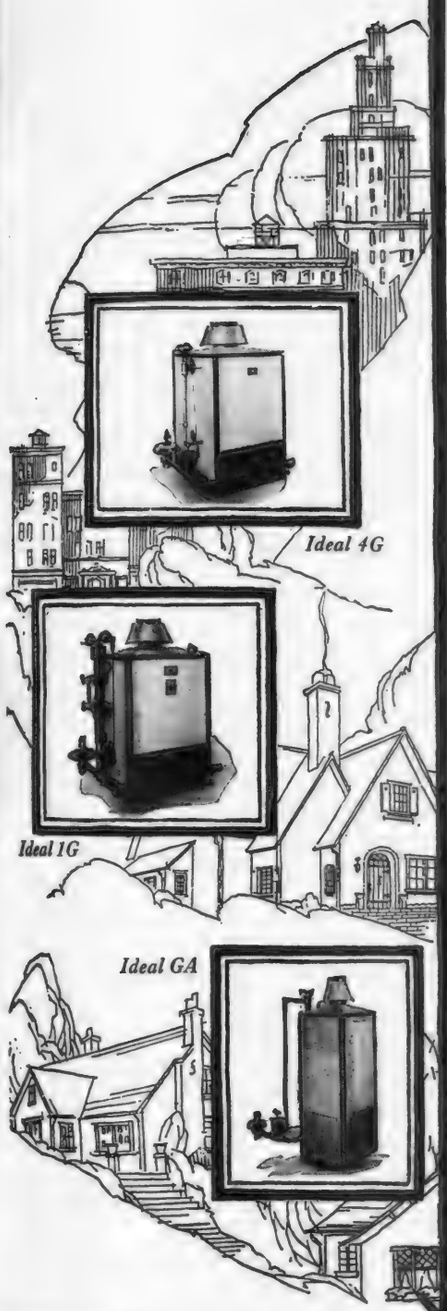
STEEL HEATING BOILERS

On almost any heating job, one of these

GAS BOILERS

is cleaner, more convenient and more profitable

to you!



For cottages or bungalows — with or without basements — an Ideal Arcola Gas Heater!

For small or medium-sized homes —Ideal 1G Gas Boiler!

For larger homes and buildings — Ideal 4G Gas Boiler!

For office buildings, big apartment houses, hotels — Ideal 4G Gas Boilers in multiple units

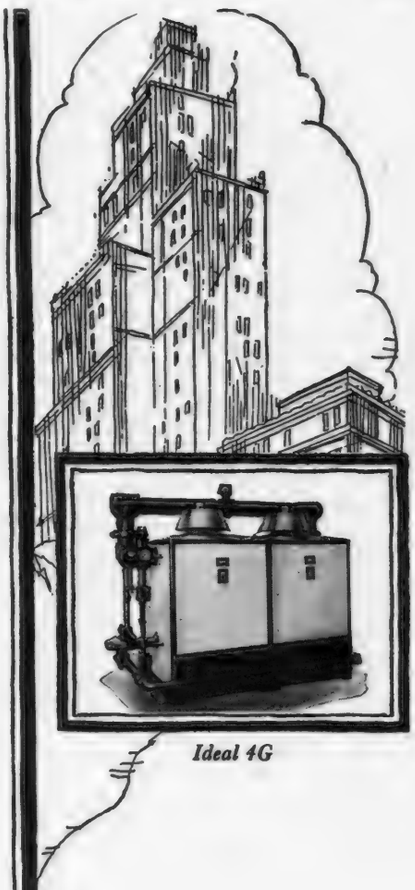
All these boilers are useful for large-volume hot-water supply and industrial applications.

LET your better customers know what it means to live in a house automatically heated by an Ideal Gas Boiler!

More and more gas companies are establishing special rates for heating, and cooperating with contractors. This means a clean net profit for you on every job. The gas company takes care of callbacks and service.

A complete range of boilers for every heating job—from a model cottage to the largest building.

Write for details



IDEAL GAS BOILERS

Product of AMERICAN RADIATOR COMPANY *Gas Utilization Dept.*

Write to AMERICAN GAS PRODUCTS CORPORATION, *Distributors*

376 Lafayette Street, New York City

"SYLPHONIZED"

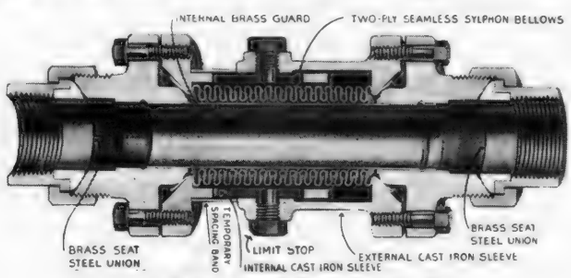
Another Great Structure Supplied with

Sylphon TRADE MARK PACKLESS EXPANSION JOINTS and Temperature Regulators

The *Sylphon* PACKLESS EXPANSION JOINT

A joint stuffed with commercial packing is bound to leak eventually. It is totally unfit for a vacuum system or a system where a slight vacuum is pulled. The over-loaded pump fails to retain the vacuum, heating efficiency becomes poor, and fuel and repair costs multiply.

The heart of the Sylphon Packless Expansion Joint is the all-metal, original and genuine Sylphon Bellows which acts as a continuous yet flexible barrier to steam escape. It is steam tight now, tomorrow or ten years from today, requires no attention, and yet has perfect freedom of motion without risk of "jamming." It does away with "Expansion loops," those story-height space wasters. No more packed or "sliding sleeve" expansion joints, almost impossible to repack in the case of a riser concealed in furring.



Cut Open View of Expansion Joint

Sylphon dependability is acknowledged by the Nation's leading architects, engineers and contractors. That is why in the majority of cases the modern home, factory, hotel, office, or public building is "Sylphonized."

Send for complete data as to sizes, prices, shipping weights.

Send for full descriptions in Bulletin W

SEE OUR CATALOGUE IN SWEETS

Whether the Job Be Large or Small It Will Pa

THE FULTON SYLPHON COMPANY
KNOXVILLE, TENNESSEE

Representatives in all principal cities of the U. S. A.
European Representatives, Crosby Valve & Engr. Company, Ltd., 41-2 Foley St., London, W. 1, England
Canadian Representatives, Darling Bros., Ltd., 140 Prince St., Montreal, Que., Canada

Sylphon TRADE MARK CONTROL

In Philadelphia's Largest Building

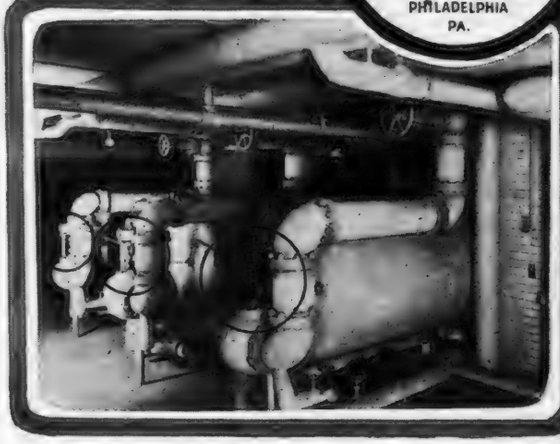
This masterful combination of beauty and utility rising 377 feet from the street level is the Quaker City's most impressive structure.

Its architecture is a monument to the ability of Simon and Simon, Philadelphia, and the heating equipment installed by W. M. Anderson of Philadelphia is hardly surpassed.

Sylphon Automatic Temperature Control

was specified and is employed throughout this great building, not only Sylphon Packless Expansion Joints in the heating risers, but in the positive temperature regulation of storage tank heaters.

The FIDELITY PHILADELPHIA TRUST BUILDING PHILADELPHIA PA.



The *Sylphon* No. 930 Temperature Regulator

Five Sylphon No. 930 Regulators are employed. At the right is shown the installation of three No. 930 Regulators on storage tank heaters.

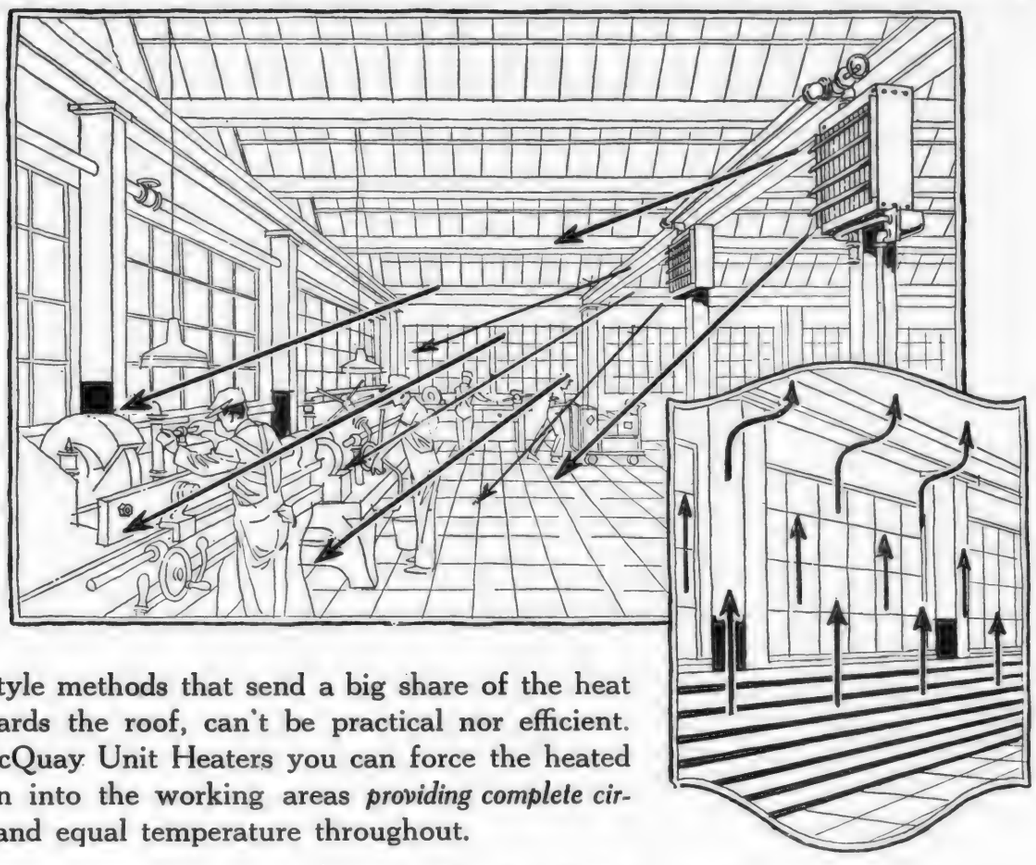
These Regulators contain as their expansion element, as do all Sylphon instruments, the famous all-metal Sylphon Bellows, the one-piece, solderless, flexible and durable diaphragm, the most efficient expansion member known to science.

You to Install *Sylphon* Dependable Specialties

THE FULTON SYLPHON COMPANY
KNOXVILLE TENNESSEE

Originators and Patentees of the Sylphon Bellows

Are You Wasting Heat?



Old style methods that send a big share of the heat up, towards the roof, can't be practical nor efficient. With McQuay Unit Heaters you can force the heated air down into the working areas *providing complete circulation* and equal temperature throughout.

For quicker more efficient heating

McQUAY UNIT HEATERS

In factories, large offices, stores, etc.

You have instantaneous heat control. Turn on the heat and the fan and immediately the heated air starts circulating through the areas where it is needed.

McQuay Unit Heaters cut your heating costs in two ways: *They cost less to install.* And they get the heat where it is needed, eliminating waste and *cutting the fuel bill.*

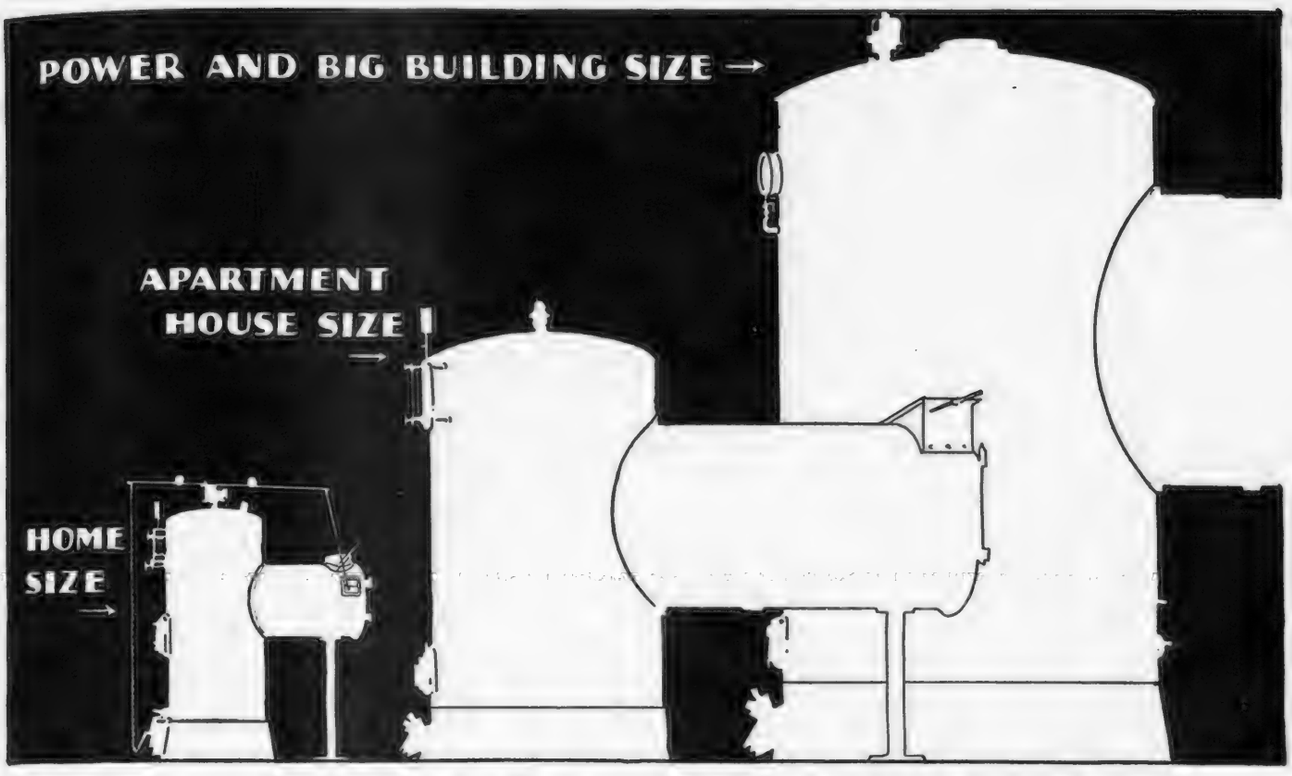
A recent McQuay installation ran approximately $5,000, as against the $7,500 estimated for old type of equipment—*a saving of one-third.* And the fuel savings usually run from 25 to 50%.

In sizes equivalent to from 50 to 650 feet, and larger. Easily installed in any building—new or old.

Ask your heating engineer, or contractor, or our nearest office.

McQUAY RADIATOR CORPORATION General Sales Office: Pure Oil Building, Chicago

Boston: 10 High St. New York: 2148 Graybar Bldg. Cleveland: 291 E. 149th St.
Newark, N. J.: J. F. McLaughlin Co., 738 Broad St. Pittsburgh: Bushnell Mach. Co., Century Bldg.



A STEEL BOILER FOR EVERY HEATING NEED

STEEL BOILERS have always been associated with large building construction. Big Fitzgibbons boilers have been used for years in this type of installation. Now the home owner is able to enjoy their many advantages. The Fitzgibbons Boiler Company has placed the construction of medium sized and small steel boilers on a production basis. Thus without impairment of quality or change of design they have made Fitzgibbons Steel Boilers available not alone for skyscrapers, office buildings and institutions, but for all types of construction at prices comparable with those asked for old type boilers.

This brings to the home owner and small building owner fuel economy, heating efficiency and freedom from maintenance cost such as heretofore has only been experienced by users of big Fitzgibbons Boilers. Steel boilers of Fitzgibbons design are recognized everywhere as the ultimate in heating performance.

FITZGIBBONS BOILER CO., INC.
570 SEVENTH AVENUE NEW YORK, N. Y.
Works: Oswego, New York

Branches and Representatives

Baltimore	Buffalo	Pittsburgh	Reading	San Antonio
Boston	Detroit	Pittsfield	Richmond	Syracuse
Bridgeport	Louisville	Philadelphia	Rochester	Winston-Salem

SKYSCRAPERS, SCHOOLS, APARTMENTS, HOMES

An ANNOUNCEMENT

IN the next issue of this magazine we will publish an advertisement that will be of particular interest to manufacturers and to distributors of oil burners.

. . . . *Watch for it*

One of our functions is to offer to manufacturers using Copper, Brass and Bronze the complete facilities of our research staff. If we can be of assistance to you, call on us.

COPPER & BRASS
RESEARCH ASSOCIATION
25 Broadway, New York

Midwestern Office	*Canadian Office*	*Pacific Coast Office*
Landreth Building	67 Yonge Street	Architects Building
St. Louis, Mo.	Toronto, Ont.	Los Angeles, Cal.

COPPER, BRASS, BRONZE — *The World's Most Useful Metals*

Our Contribution
to the art of Heating & Ventilation

FIVE YEARS AGO when the Herman Nelson light weight, compact, indestructible radiator was placed on the market, it was immediately accepted as the greatest advance in the art of Heating and Ventilation in a generation. It has made possible heating and ventilation dependability and performance hitherto unattainable.

The Herman Nelson Wedge Core Radiator is an exclusive feature of all Herman Nelson Heating and Ventilating Products and accounts for their unequaled performance.

UNIVENT

for the ventilation of schools, hospitals, offices and other buildings presenting an acute ventilating problem.

HERMAN NELSON *Invisible* RADIATOR

... supersedes all previous radiators, radiator cabinets or enclosures. Occupies no room space and makes possible any desired decorative scheme or furniture arrangement. Indestructible in service.

THE HERMAN NELSON hiJet UNIT HEATER

It operates at steam pressures from 1 to 150 lbs., and offers the better and more economical way of diffusing heat in Factories, Railroad Shops, Roundhouses, Mills, Warehouses, Garages, Gymnasiums and Industrial Buildings.

Herman Nelson Radiator Sections
for Blast Heating and Cooling

Indestructible, operating at any steam pressure from 1 to 150 lbs., non-corrosive and leak-proof.

May be arranged in banks to solve any special problem of heating or cooling.

HEATING ∿ VENTILATING ∿ COOLING ∿ DRYING ∿ CONDENSING

THE HERMAN NELSON CORPORATION ∿ *Moline, Illinois*

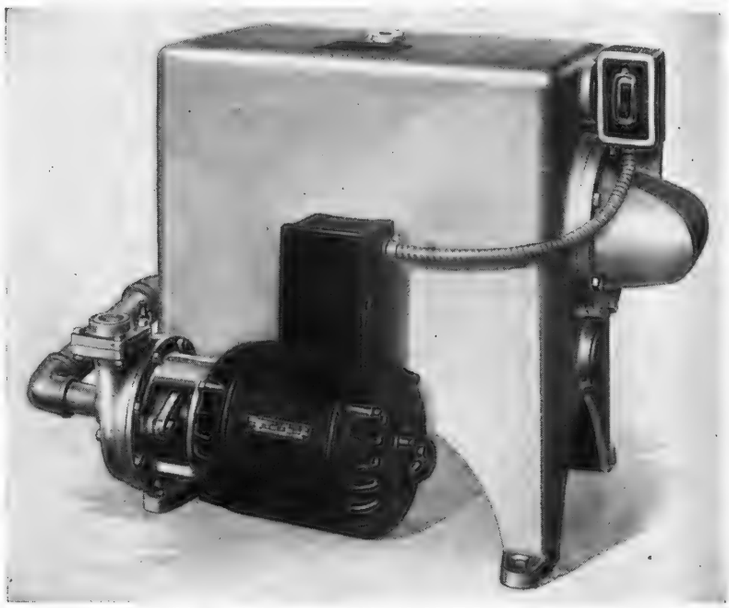
Builders of Successful Heating and Ventilating Equipment for over 20 Years

Sales and Service

BELFAST, ME.	BUFFALO	CHARLOTTE, N. C.	CLEVELAND	INDIANAPOLIS	GREEN BAY	ATLANTA	KANSAS CITY	SPOKANE	VANCOUVER
BOSTON	PHILADELPHIA	GRAND RAPIDS	COLUMBUS	CHICAGO	MINNEAPOLIS	MEMPHIS	OMAHA	PORTLAND	TORONTO
NEW YORK CITY	SCRANTON	SAGINAW	CINCINNATI	DES MOINES	ST. LOUIS	DALLAS	DENVER	SEATTLE	WINNIPEG, MAN.
UTICA	PITTSBURGH	DETROIT	TOLEDO	MILWAUKEE	BIRMINGHAM	EMPORIA	SALT LAKE CITY	SAN FRANCISCO	CALGARY, ALTA

THE OWNER SAVES ON CURRENT, YOU SAVE ON ELECTRICIAN'S FEES

Like all Trane equipment, Trane Condensation Pumps are designed for definite economies



Not satisfied with the high standing already attained by Trane Pumps, Trane engineers last year developed new designs with the most remarkable efficiencies yet reached in small centrifugals for general purpose work.

The difference in power requirements is amazing. ¾ H. P. motors do work that formerly required One or 1½ H. P. On the larger units, 7½ H. P. motors do the work that 10 H. P. did before. The owner saves $2.00 to $4.00 a month on small pumps, $6.00 to $12.00 a month on the larger ones, *on power cost alone.*

The contractor saves $10 to $20 on electrician's fees because the entire outfit, with switch and motor protective equipment, is mounted on one base and wired at the factory. The wiring job is reduced to hooking up the feed wires.

This constant refinement is a permanent part of the Trane policy. Applied to Trane Unit Heaters, it has resulted in an equally important development—a capacity increase of 40% to 50% with practically the same factory cost! This high-grade equipment now competes on a price basis with the lowest-priced units on the market — without sacrificing a single one of the features which obtained such remarkable recognition for Trane Unit Heaters during their first year in the field.

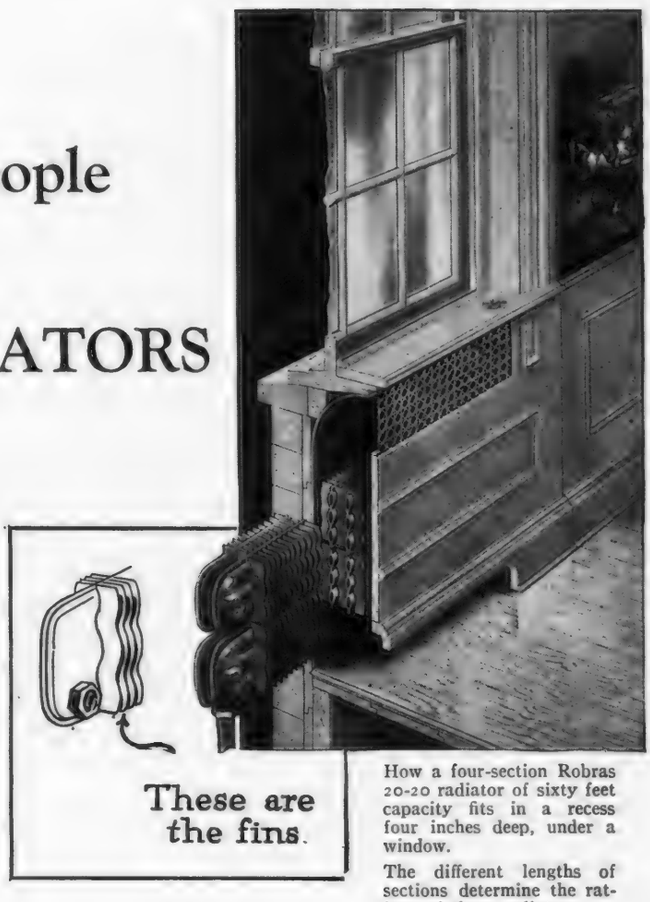
~ ~ ~

Remember, before you buy or recommend any part of a heating system except the boiler or piping, to find out what Trane has done recently to improve that particular product.

THE TRANE CO., (*Dept. 2*)
206 Cameron Avenue La Crosse, Wis.

HEAT CABINETS **TRANE** CONCEALED HEATERS
PUMPS, UNIT HEATERS, AND HEATING SPECIALTIES

How Can I Tell People *Why* ROBRAS 20-20 RADIATORS Take Up So Little Space?



How a four-section Robras 20-20 radiator of sixty feet capacity fits in a recess four inches deep, under a window.

The different lengths of sections determine the ratings of these radiators.

When people ask you, "How can such a little radiator give out as much heat as the old kind?" you can say:

"Because both sides of the thin fins, at right angles to the prime surface of the radiator, are heating surfaces, throwing off heat at higher temperatures than could the old fashion radiators.

"Then because the fins of each section form flues when enclosed singly, or in multiple sections, which accelerate the flow of air. Thus the air in the room is brought more frequently through the radiator.

"These radiators go in-the-wall, out-of-sight and out-of-the-way. They heat up more quickly. None of the heat is wasted through radiation through the outside walls."

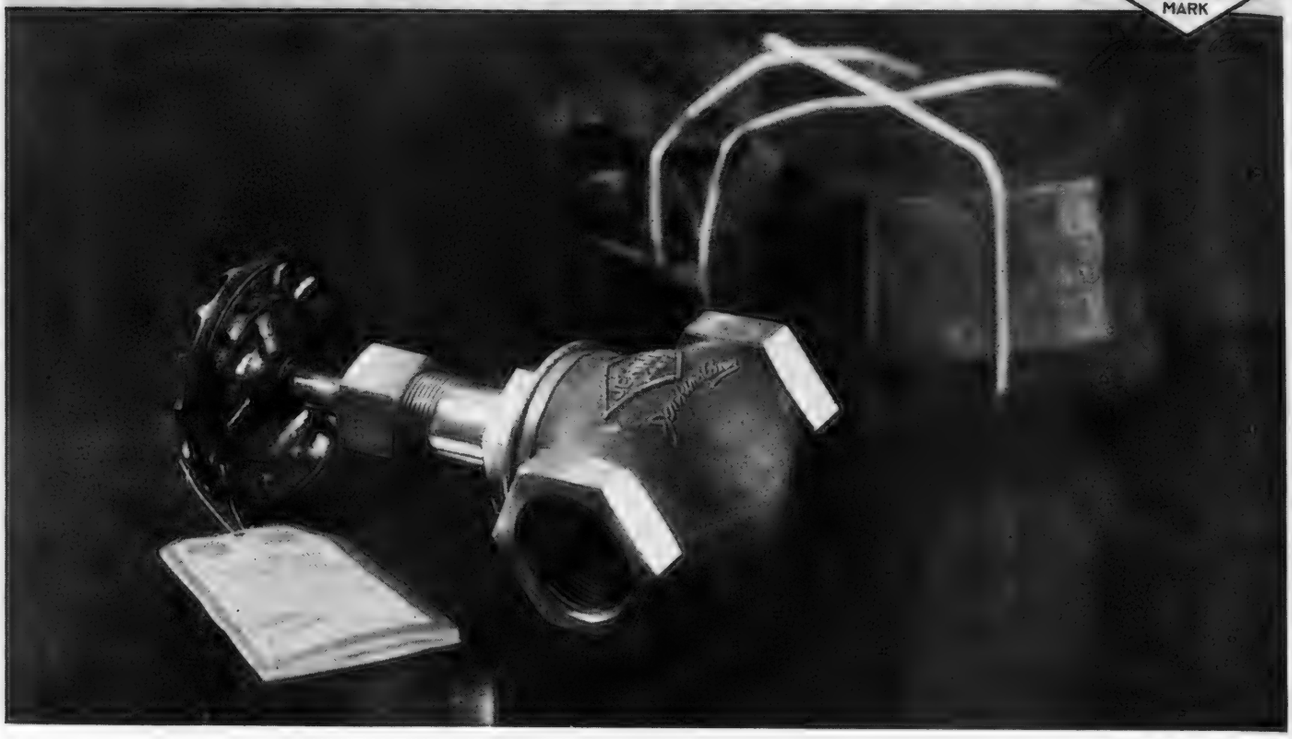
Due to the ease of installing, your profit in these radiators is greater. Your customers' satisfaction of having the radiators out of sight is great. Write for price list and data sheets. They are all ready to be mailed as soon as we have your name.

ROME BRASS RADIATOR
CORPORATION

ONE EAST FORTY-SECOND STREET :-: :-: NEW YORK CITY

Jenkins VALVES ARE ALWAYS MARKED WITH THE "DIAMOND"

TRADE JENKINS MARK



Easy installation—complaint-free service

When labor saving means money saving, use a Jenkins. Accurate fitting, true dimensions and exact machine threading are assured in a Jenkins Valve, making installation quick and easy.

When complaint-free valve performance is required, select a Jenkins. Easy operation and tight closing are characteristic of a Jenkins Valve.

When long life is demanded of a valve, install a Jenkins. Analyses-proven metals, excellence of design, rigid tests and thorough inspection—quality in every detail of a Jenkins assures long term service.

Your supply man can furnish Jenkins Valves of bronze and iron in standard, medium and extra heavy patterns.

JENKINS BROS.

80 White Street, New York, N. Y. 133 North Seventh Street, Philadelphia, Pa.
524 Atlantic Avenue, Boston, Mass. 646 Washington Boulevard, Chicago, Ill.
JENKINS BROS., Limited, Montreal, Canada; London, England
Factories: Bridgeport, Conn.; Elizabeth, N. J.; Montreal, Canada

Jenkins
VALVES
Since 1864

THE WILLIAMSBURGH SAVINGS BANK
New Central Office Building
Hanson and Ashland Places at Flatbush Avenue
Brooklyn

HALSEY, MCCORMACK & HELMER
Architects

FRANK SUTTON
Engineer

WM. KENNEDY CONSTRUCTION CO.
General Contractors

ALMIRALL & COMPANY
Heating Contractors

MARSH CONE DISC MODULATED VALVES

Fig. 147

used throughout on this job

Cone Disc Modulated
Fig. 147

MARSH VALVE COMPANY

DUNKIRK NEW YORK

General Sale Distributors

Edward T. Hetherington
1709 Sanson St., Philadelphia

Appleton & Liptrott, Inc.
1480 Broadway, New York

John W. Mabbs
431 So. Dearborn St., Chicago, Ill.

United States Radiator Corp'n
General Offices: Detroit, Mich.

SARCO COMPANY, Inc.
183 Madison Ave., New York

Taylor-Forbes Company
Canadian Agents Guelph, Ont.

UNIVERSITY *of* CHICAGO CHAPEL

— a Rockefeller Foundation contribution to the University of Chicago, which realizes the original intention of including for this institution a building devoted solely to religion and its exercises.

Bertram Grosvenor Goodhue, New York, was the architect commissioned to create the design and supervise its completion.

Mr. Goodhue visited the notable Cathedrals of Europe for proper inspiration, and embodied for this chapel the fundamental features distinguishing those renowned works of ecclesiastical architecture.

The wood carving, stone cutting and figure work, and likewise the huge organ, are all of European artistry and workmanship.

Unlimited scope for originality and accomplishment was provided and allowed. Old world character thus united with new world modern ingenuity and vigor have obtained and established a newly beautiful and expressive edifice of prayer and devotion in America.

Visitors are permitted each day to enter and view the imposing interior; likewise at services on Sunday and evenings during the week when it is especially impressing and soul inspiring.

A monument indeed to endowment kindness, and the consummate of church thought and architecture . . . . . .

JOHNSON SERVICE CO., MILWAUKEE, WIS.

JOHNSON HEAT & HUMIDITY CONTROL

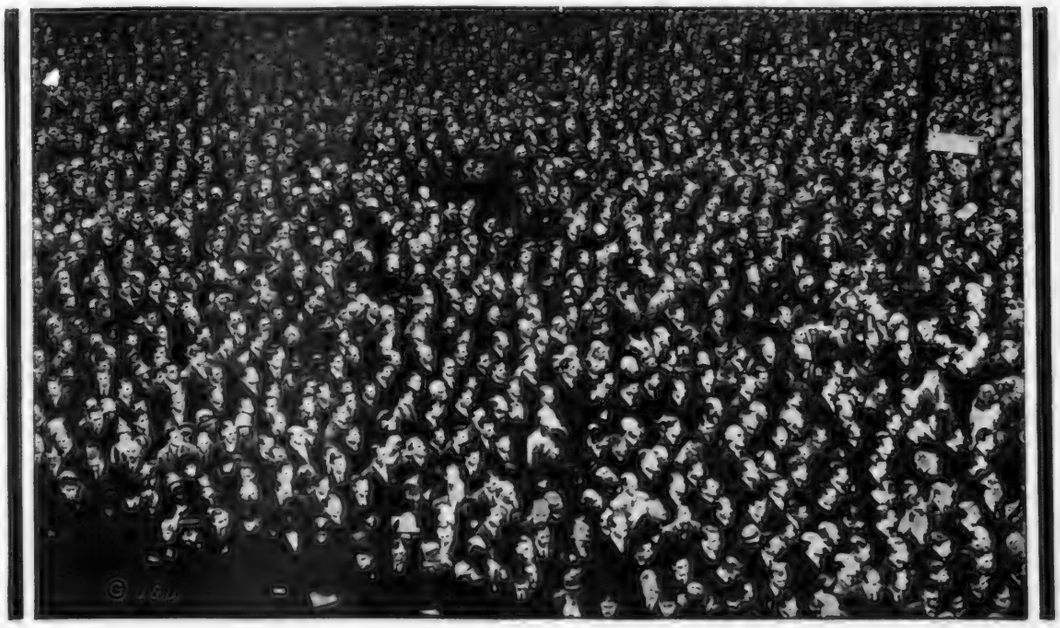
IS INCLUDED IN THE EQUIPMENT OF
UNIVERSITY OF CHICAGO CHAPEL

The All Metal System . . . .

The All Perfect Graduated Regulation Of Valves And Dampers

The Dual Thermostat (Day & Night) Control

Fuel Saving . . . 25 to 40 Per Cent



If

all of these people were placing orders with you for steam heating jobs, you could sell every one of them Arco Packless Valves No. 999. You could make the sale every time if you took five short minutes with each person and simply pointed out:

That Arco Packless Valves never need repacking, and are therefor, in the long run, less expensive than old style packed valves that must be repacked periodically—

That there is no danger of leaks which often cause costly damage to floor and rugs, for Arco Packless Valves are guaranteed not to leak—

That there is no need to turn and turn and struggle with handles that stick and bind, for Arco Packless Valves open with one smooth turn of a handle that is never hot.

When buyers know the facts, they will always select Arco Packless Valves in preference to the cheapest packed valves made.

Arco Packless Valve No. 999—Made in angle, corner and globe patterns, round or lever handle—for steam, water, vapor or vacuum installations.

AMERICAN RADIATOR COMPANY

40 WEST 40th STREET ACCESSORIES DIVISION PV-712 NEW YORK, N. Y.

"THEY KEEP A-RUNNING"

200 Horsepower

Century 60 Cycle 440 Volt 1800 R.P.M.
3-Phase Squirrel Cage Induction Motor

Century Type SC Motors are built to insure the continuous operation necessary at high speeds required by centrifugal pumps and similar apparatus, and also—in slower speeds—to meet the hard service conditions encountered in the broad range of general purpose applications—particularly in chain and gear-drive installations...They are well balanced in design, sturdy and rigid in construction, thoroughly ventilated but not easily clogged, well protected, and can be easily cleaned with an air nozzle.

The motor illustrated is equipped with Timken Double-row, Self-contained roller bearings, which are interchangeable with Double-row ball bearings.

Century 3 and 2 Phase Squirrel Cage Induction Motors are built in standard sizes from ¼ to 200 horse power. Temperature rating, 40°C.

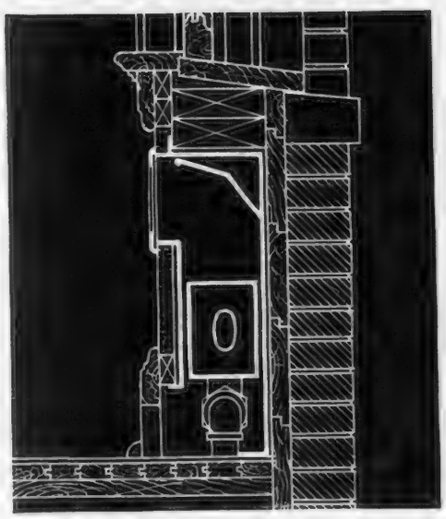
CENTURY ELECTRIC COMPANY
1806 Pine St. St. Louis, Mo.
40 U. S. and Canadian stock points and more than 75 outside thereof

Modern heaters should be felt—NOT SEEN

THERE are two good ways to estimate the age of any building. One is to read the cornerstone. *The other is to look at the heating fixtures.*

Every year the trend grows more and more rapidly away from the great, bulky fixtures of the past to the *completely concealed heater* of tomorrow. Now more than ever, the use of Circulair Heat is vital to the architect and contractor, because *it will delay obsolescence by years.*

And there are other factors. Circulair Heat consumes no valuable room-space. It harmonizes with any architectural design. It permits the placement of furniture wherever convenience may suggest. It is economical to buy and surprisingly simple to install.



Full descriptions of these years-ahead heaters, together with engineering data and photographs of many beautiful installations, are contained in the NEW Circulair catalog, just off the presses. Use the coupon for getting your copy now. Circulair Heat, Incorporated, 218 Central Ave., Louisville, Ky.

Circulair HEAT

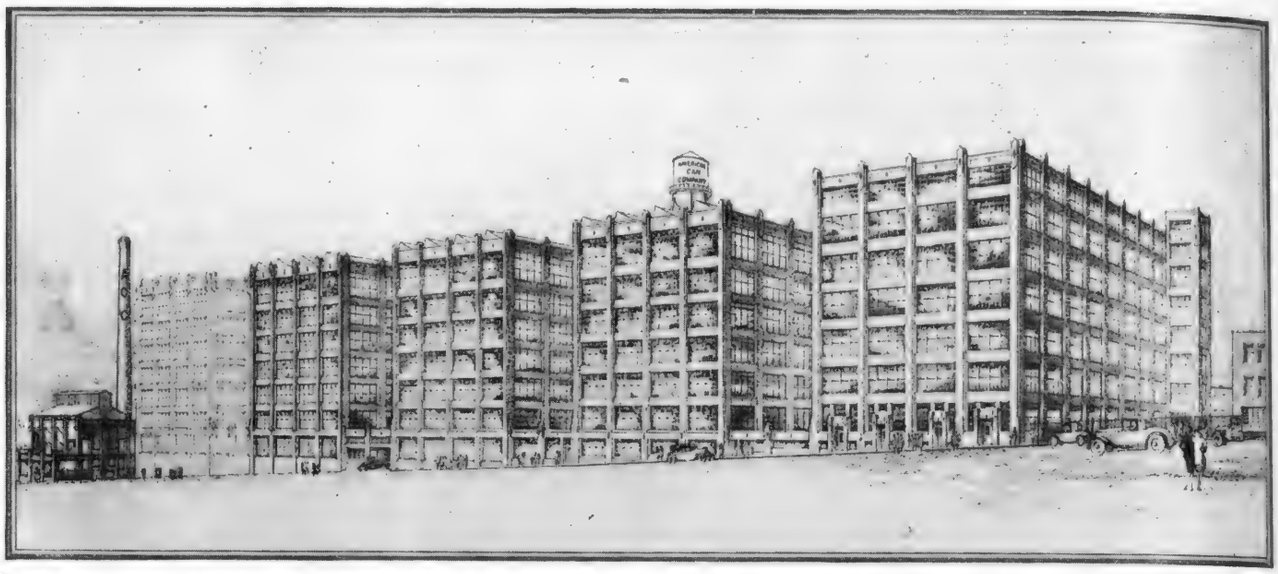
Use This

CIRCULAIR HEAT,
Incorporated, 218 Central Avenue, Louisville, Ky.
Please send, without obligating me, the complete new Circulair catalog.

Name.....

Address.....

City..... State.....



The New Hudson factory of the American Can Co. at Jersey City, N. J. The building is heated by 237 Grinnell Unit Heaters controlled by Mercoid Thermostats, many of which are used with the Grinnell Duotherm for low nighttime temperatures.

MERCOIDS

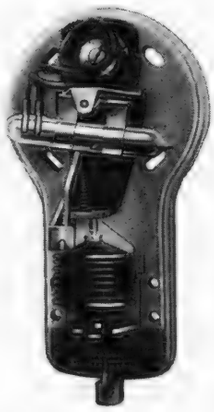
Control the 237 Unit Heaters in this great modern plant

186 Mercoid Controls are furnishing Automatic regulation for the 237 Grinnell Unit Heaters installed in the immense plant pictured above.

This is only one of the many Mercoid installations which offer convincing evidence of the growing approval of this automatic thermostat for unit heater control.

Mercoids have been so widely selected for unit heater work because they are easily installed and because they operate accurately and never require any troublesome servicing.

They also operate on full line current—either 110 or 220 volts A.C. or D.C. And since the mercury switch is tightly sealed the instrument is perfectly safe in the presence of inflammable vapors or gas. There is no open arc—no corrosion of contacts.



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The No. 845 Mercoid thermostat is furnished in two standard ranges—56° to 80° and 38° to 60°.

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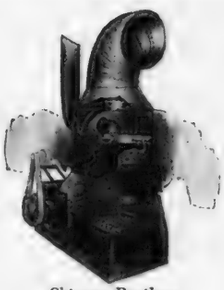

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Saved, from $6,900 to $13,400

for the owner* of this 23,000 sq. ft. building with Skinner Brothers Direct Fired Heaters

One type of heating equipment proposed for this building would have cost $16,500; another $10,000. Skinner Brothers Direct Fired Air Heaters were put in at a total cost of only $3,100, including the oil burning unit for each heater.

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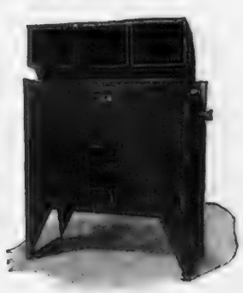

Type "U" Air Heater

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INDEX TO VOLUME XXV, 1928

Published by
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Abbott, W. R., degree-days background builds business, June 74
A. B. P. editorial contest, winners in, awarded certificates, Apr. 98
Accidents in dry-cleaning plants, proper humidity prevents, Apr. 97
Aeration of industrial buildings, W. C. Randall, Feb. 94
Afghanistan, how they keep warm in, George Cecil, Apr. 93
Air conditioning.
  calculations for a typical theatre, data sheets, Jan. 98A, Feb. 114A, Mar. 98A
  in a movie theatre, Aug. 64
  in southwest theatre, Feb. 73
  in Wisconsin Schools, H. W. Schmidt, Nov. 58
  or heating only for the modern plant?, H. P. Gant, Feb. 94
  refrigeration as applied to industrial, R. W. Waterfill, Sept. 75
Air, cost of clean, for operating rooms, May 105
Air distribution, methods of, L. L. Lewis, Aug. 91
  papers presented at semi-annual meeting of A.S.H. & V.E., July 106
Air ducts, pressure losses in, William D. Edwards, Feb. 69
Air pollution problems discussed at annual meeting of A.P.H.A., Peter H. Bryce, M.D., Dec. 84
Alt, Harold L., design of lumber dry kilns, Jan. 101
  heating and ventilation specifications, Mar. 83, Apr. 74, May 80, July 80, Aug. 72, Sept. 71, Oct. 66, Nov. 69
  simplification needed in radiator manufacture, Feb. 75
  status of district heating, June 72
  what pressure steam distribution for tall buildings, Dec. 60
American Blower Corporation, historical description of, Oct. 96
American District Steam Company, historical record of, Apr. 99
American Gas Association dedicates new laboratory, Oct. 75
American Gas Association.
  Eugene D. Milener with association, Jan. 103
  construction started on new testing laboratory for association, Mar. 117
  how should domestic service water be heated?, Apr. 106
  cornerstone laid of new laboratory, May 97
  new award by association, June 109
  industrial gas course to be held in New York, Sept. 96
  convention program, Sept. 96
  testing laboratory to be largest in world, Sept. 96
  gas industry to be represented at World Fuel Conference, Sept. 96
  association engaged in many research activities, Sept. 96
  dedication of new testing laboratory, Oct. 75
  annual convention scheduled for Oct. 8-12, Oct. 88
  house heating featured at Atlantic City convention, Nov. 75
  report of annual meeting, Nov. 75
  report of subcommittee on converted installations, Nov. 78
  report of subcommittee on large building heating, Nov. 80
American Oil Burner Association.
  sub-committee appointed, Jan. 108
  is gas a real competitor of oil?, Jan. 108
  association incorporates, Feb. 107
  plans completed for fifth annual convention in Chicago, April 3-5, Mar. 106
  domestic oil burners of today, Mar. 108, Apr. 103
  exhibitors at the convention in Chicago, Mar. 106, Apr. 104
  fifth annual convention imparts sense of stability to oil-burner industry, May 85
  report of convention at Chicago, April 3-5, May 85
  new officers and directors, May 88
  exhibits at the convention, May 91
  directors meet, July 112
  Boston association joins A.O.B.A., July 112
  Springfield association formed, July 112
  T. W. Yocum new executive of oil-burner organizations, Sept. 94
  new directors for associate division, Oct. 98
  association and Oil Heating Institute move their offices, Nov. 100
American Petroleum Institute.
  petroleum interests stand behind oil-burner industry, Jan. 108
American Public Health Association.
  appoints committees, Aug. 82
  discusses air pollution problems at annual meeting, Peter H. Bryce, M.D., Dec. 84
American Radiator Company inaugurates million-dollar replacement campaign, June 94
American Society of Heating and Ventilating Engineers.
  program for annual meeting, Jan. 109
  summer meeting at West Baden, Jan. 109
  open house at laboratory and meeting of council, Jan. 109
  Guide for 1928, Jan. 109
  H. P. Gant addresses Philadelphia chapter, Jan. 110
  joint meeting of Buffalo chapter and Engineering Society of Buffalo, Jan. 110
  new officers of Pittsburgh chapter, Jan. 110
  Wisconsin chapter elects officers, Jan. 110
  New York chapter members inspect subway construction, Jan. 110
  welding subject of New York chapter meeting, Jan. 110
  Michigan chapter discusses future of cooling systems, Jan. 111
  Chicago executive addresses Illinois chapter, Jan. 111
  spirit of the A.S.H. & V.E., Jan. 111
  insulation manufacturers and the A.S.H. & V.E. insulation code, Jan. 112
  heating engineers review work of the year, Feb. 87
  report of the annual meeting at New York, Jan. 23-26, Feb. 87
  test methods for radiators and boilers, Feb. 88
  proposed methods for testing radiators, Feb. 88
  practical ventilation for schoolrooms, Feb. 91
  school ventilation, Feb. 92
  unit ventilators in schools, Feb. 93
  what will the engineer choose—heating only or air conditioning for the modern plant?, Feb. 94
  aeration of industrial buildings, Feb. 94
  dairy stable ventilation, Feb. 95
  corrosion in steam heating systems, Feb. 95
  preliminary boiler tests in Kentucky laboratory, Feb. 96
  output-operating characteristics of low-pressure boilers, Feb. 96
  boiler rating code committee asks for time, Feb. 97
  standard test code for heat transmission through walls, Feb. 98
  utility demands of a modern hospital, Feb. 98
  when should building insulation be used?, Feb. 99
  past presidents' dinner, Feb. 99
  Benjamin Franklin honored at annual dinner, Feb. 101
  meeting of nominating committee, Feb. 101
  inauguration of Institute Thermal Research, Feb. 101
  Illinois chapter discusses unit heaters, Feb. 112
  Illinois chapter told of work of New York commission on ventilation, Feb. 112
  New York chapter discusses building insulation, Feb. 112
  inspection of University of Minnesota experimental engineering laboratories, Feb. 112.
  progress of boiler rating movement, Feb. 113
  committee on research requests uniformity in radiator ratings, Mar. 101
  appointment of council committees, Mar. 101
  President Willard guest of Illinois chapter, Mar. 101
  New York chapter hears talk on industrial marketing, Mar. 101
  Michigan chapter meetings, Mar. 101
  Mrs. Frank addresses Pittsburgh chapter, Mar. 101
  Holland Tunnel medal presented to President Willard, Apr. 95
  Samuel R. Lewis re-elected chairman of the committee on research, Apr. 95
  President Willard guest of Michigan chapter, Apr. 95
  Illinois chapter hears talk on thermal engineering, Apr. 95
  Pacific Northwest chapter organized, Apr. 95
  Kansas City chapter meeting, Apr. 95
  Perry West as technical advisor, Apr. 95
  plans for semi-annual meeting, May 106
  council meets and chooses Chicago for next annual meeting, May 106
  boiler rating committee meets in Pittsburgh, May 106
  Illinois chapter has big April meeting, May 106
  Michigan chapter meeting, May 107

program for 34th semi-annual meeting, June 103
annual meeting of New York chapter, June 103
association for correlating thermal research, June 103
technical advisory committee appointed, June 103
President Willard addresses engineers at University of Kentucky, June 103
western New York chapter meeting, June 104
Minnesota chapter, June 104
President Willard pays a fine tribute to Dean Anderson, June 104
manufacturers' interests prevent adoption of boiler code, July 100
report of semi-annual meeting in West Baden Springs, June 26-29, July 100
development of gas heating for homes, July 100, Aug. 93
great future ahead for gas heating, July 101
method of calculating cost of gas heating, July 101, Aug. 94
operating data on federal buildings, July 101, Aug. 95
heating industrial buildings with warm air, July 102
design and performance of domestic oil burners, July 102
heat transfer through roofs under summer conditions, July 103
coefficients of heat transfer as measured under natural weather conditions, July 103, Aug. 96
heat transmission research, July 104
report of boiler-rating code committee, July 105
report of committee on code for heating and ventilating garages, July 105
study of dust determinators, July 105
air leakage through a window, July 106
air leakage through a pivoted metal window, July 106
weathertightness of rolled section steel windows, July 106
effect of frame calking and storm windows on infiltration around and through windows, July 107
refrigeration as applied to air conditioning, July 107, Aug. 75
heating and ventilating problems of gas cell manufacture for air ships, July 107
chapter meetings, July 107
methods of air distribution, Aug. 91
chapter meetings, Aug. 96
Guide publication committee faces problem, Sept. 78
annual open house of the research laboratory, Nov. 96
Harding elected chairman of research committee, Nov. 97
Michigan chapter meeting, Nov. 97
boiler rating code committee work progresses, Nov. 97
air delivery from unit heaters to be studied, Nov. 97
new data in 1929 Guide, Nov. 98
nominations for research committee, Nov. 98
New York chapter holds first meeting, Nov. 98
Illinois chapter opens winter season, Nov. 98
conference on methods of calculating heat losses, Dec. 91
New York chapter meeting, Dec. 91
Illinois chapter meeting, Dec. 92
Western New York chapter meeting, Dec. 92
Willard to address Massachusetts chapter, Dec. 92
Kansas City chapter meeting, Dec. 92
Michigan chapter meeting, Dec. 93
American Standards Association, A.E.S. committee becomes, Aug. 101
Anthracite burning equipment, laboratory to investigate design of, Dec. 101
Apprenticeship training, F. P. Elliott, Dec. 58
American Society of Mechanical Engineers.
fuels meeting to be held in Cleveland, Sept. 95
research committee to study combustion in domestic furnaces, Apr. 105
Atlantic City's New Convention Hall, Details of Design for, Jan. 67
Atmosphere, the dust of the outer, in relation to health, Peter H. Bryce, M.D., Feb. 102
Atmospheric conditions, New York City authorities investigate, Jan. 94
Austin, F. G., the status of district heating, May 76

Babcock, Paul R., new radiation tables, May 68
Beals, George D., public building ventilation with automatic roof ventilators, Feb. 84
Berlin Municipal Heating Works, Jan. 71
Blackall, A. C., tubular electric heating system used in Great Britain, Aug. 70
Blaker, Edward T., heating and ventilation of a large garage, June 69
Blansjaar, J., "the next size larger," Apr. 76, May 82
Boiler be rated on basis of heat delivered at outlet?, should a, Apr. 83
Boiler, British, burning low-grade fuels, shows high efficiency, Sept. 69
Boiler rating an engineering or a trade problem?, is, Jan. 89
Boiler-rating code committee, report of, July 105
Boiler tests in Kentucky laboratory, preliminary, L. S. O'Bannon, Feb. 96
Boilers of two different makes, equalizing, Mar. 99
Boilers, output-operating characteristics of low-pressure, Percy Nicholls, Feb. 96
Brabbee, Dr. C. W., test methods for radiators and boilers, Feb. 88
Bracken, J. L., 12,000,000 railroad passengers served by oil heat, Mar. 69
Bryce, Peter H., M.D., health and ventilation, Feb. 102, Mar. 97, Aug. 84, Dec. 84
impasse in the school ventilation situation, Jan. 91
B.T.U. basis, radiator ratings on, Harold L. Alt, Feb. 75, A. H. Schroth, Feb. 78
B.T.U. basis urged for British radiator ratings, June 102
B.T.U. club, what it is and how to use it, Mar. 94
automobile parking scheme that simplifies ventilation problem, May 99
ballyhooing the unsophisticated, Apr. 87
idea for a boiler feeder, Oct. 80
la maison nouvelle, Apr. 86
pessimism and optimism, Apr. 87
pressure, effect of, on fuel consumption, Oct. 79, Nov. 83
why 240?, May 99
Buck, Everett S., theatre air conditioning in the southwest, Feb. 73
Buffalo Forge Company, historical description of, Dec. 99
Build a basement? why, Oct. 78
Building volume to continue during 1928, huge, Feb. 110
Bureau of Mines issues analyses of petroleums of the United States, Sept. 90

Canadian government sponsors house insulation, Jan. 100
Canadian Oil Burner Association.
association formed, Jan. 108
meeting in Chicago, May 92
Canadian plumbing and heating guild, first meeting of the, Mar. 107
Carnahan, G. C., gas heating for the heating contractor, June 63, July 68, Aug. 58, Sept. 57
Cecil, George, how they keep warm in Afghanistan, Apr. 93
Central Illinois Light Company, district heating for the, Sept. 64
Charts and graphs, Nov. 85
Chicago master steam fitters' survey on rehabilitation work, June 87
Chicago Oil Burner Association.
heating contractor tells of oil-burning experiences, Apr. 105
March and April meetings, May 92
June meeting, July 112
September meeting, Oct. 98
October meeting, Nov. 100
Chicago power show, heating and ventilating exhibitors, Feb. 119
Church school, heating and ventilating a large, Mar. 74
Churches, electric heating of, William Sommer, Apr. 65
Coal bill, saving on the, by using small size coal, C. F. Smith, Dec. 63
Coal boilers, burning gas in, Clifford Strock, Nov. 53, Dec. 71
Coal consumption, accuracy of degree-day basis for figuring, Jan. 100
Code committee, boiler rating, asks for time, Feb. 97
Code of ethics for salesmen, Jan. 113
Colors in household equipment may prove boomerang, Sept. 88
Combustion with domestic oil burners, R. T. Haslam, Mar. 79
Concealed radiation has transformed the appearance of home and office, how, Apr. 72
Concealed radiation, test data on, Mar. 96
Conference of trade commissions and publishers, Nov. 91
Conner, R. M., testing central heating plants using gas as fuel, Oct. 80
Conversions, gas, and economizers, descriptions of, Clifford Strock, Nov. 53, Dec. 71
Copper producers form an institute, American, Jan. 94
Correspondence.
air valve on tube radiation, best location for, Aug. 89
another method suggested for how would you do it? problem, Oct. 87
arc welding prevents corrosion, Apr. 102
Boston school system, May 105
degree-days and the demand factor in heating, Feb. 107
equalizing boilers of two different makes, Mar. 99
fans, use of, to increase effectiveness of radiators, May 105
heating a suburban home with gas, Dec. 88
heating system, how to connect a one-pipe and a vacuum-return, Sept. 86
heating systems, a comparison of vapor, water and one-pipe steam, July 114
improving the "Underwriters" boiler connection, Nov. 90
mechanical equipment for tall buildings, Dec. 88
"of that balminess redolent of spring," Feb. 107
offsetting body heat output, Aug. 89
one chimney for three oil-burning boilers, No. 91
one-pipe and vacuum system together?, is it practical to operate a, Nov. 90
penalty for delay in completion of contract, Dec. 88
proper location of the air valve venting mains, Sept. 88
radiators, effect of enclosures on heat emission of, Nov. 89
radiators, proper connections to, located below the steam main, Aug. 89
sex appeal in sectional boilers, Nov. 91
smoke stack built of plumbing material does not produce draft, Dec. 87
static pressure, an electrical analogy of, Sept. 86
steam main, reason for terminating a, full size below water line, June 98
temperature, determining room, and proportionate fuel costs for two tenants, June 96
tunnel projects follow success of Holland tubes, huge, Nov. 90
wall temperatures during heating-up period, Aug. 90
water hammer, cause of, in two different heating systems, July 114
vent pipe, best location for, on expansion tank, June 98
Corrosion in steam heating systems, F. N. Speller, Feb. 95
Cost of comfort, new book by National Lumber Manufacturers Association, Nov. 99

Daniels, A. M., new home-study course in gravity steam and water heating.
Lesson 29. (cont'd) Jan. 84
Lesson 30. Feb. 81
Data sheets, standard heating and ventilating.
No. 20L—air conditioning — calculations for a typical theatre, Jan. 98A
No. 20M—air conditioning — calculations for a typical theatre (cont'd), Jan. 98A
No. 20N—air conditioning — calculations for a typical theatre (cont'd), Feb. 114A
No. 20O—air conditioning — calculations for a typical theatre (cont'd), Feb. 114A
No. 20P—air conditioning — calculations for a typical theatre (Cont'd), Mar. 98A
No. 13H3—radiation computing—exposure factors for H.&P.C.N.A. radiation tables, Mar. 98A
radiation computing — standard radiation estimating tables.
No. 13I3—Baltimore, Md., Apr. 98A
No. 13J3—Albany, N. Y., Apr. 98A
No. 13K3—Chicago, Ill., May 98A
No. 13L3—Norfolk, Va., May 98A
No. 13M3—Syracuse, N. Y., June 98A
No. 13N3—Richmond, Va., June 98A
No. 48H—oil burning—oil fuel specifications, July 114A
No. 48I—oil burning—oil fuel specifications (cont'd), July 114A
No. 48J—oil burning, oil fuel specifications, (cont'd) Aug. 90A
No. 48K—oil burning, oil fuel specifications, (cont'd) Aug. 90A
No. 48L—oil burning—oil fuel specifications, (cont'd) Sept. 98A
No. 48M—oil burning—oil fuel specifications, (cont'd) Sept. 98A
No. 48N—oil burning—oil fuel specifications, (cont'd) Oct. 98A
No. 48O—oil burning—heating values of fuel oil, (cont'd) Oct. 98A
No. 50—gas heating—dimensions for draft diverters, Nov. 98A
No. 50A—gas heating—gas requirements for average installations, Nov. 98A
No. 50B—gas heating—capacities of gas pipe, Dec. 98A
No. 50C—gas heating—characteristics of various gases, Dec. 98A
Davie, R., replacement work is profitable, Sept. 67
De Bothezat, George, Dr., dynamic significance of static pressure, May 65, June 79
Degree-day basis for figuring coal consumption, accuracy of, Jan. 100
Degree-days background builds business, W. R. Abbott, June 74
heating a suburban home with gas, E. C. Uhlig, Oct. 53

monthly heating loads in, in New York, Boston, Pittsburgh, Chicago, St. Louis, Minneapolis, San Francisco, Denver and Seattle, Jan. 106, Feb. 122, Mar. 104, Apr. 92, May 104, June 102, July 108, Nov. 95, Dec. 96
studying the heating load, P. E. Fansler, July 108
Degree standards, Polytechnic Institute raises engineers', Feb. 113
Delany, S. F., the status of district heating, July 76
District heating, the status of, Mar. 87, Apr. 80, May 76, June 72, July 76, Aug. 64
District steam, "tower buildings" use, Aug. 86
Domestic heating apparatus valued at over $200,000,000, yearly production of, Jan. 97
Downward ventilation for an office building, Samuel A. McGuire, Dec. 53
Duffield, Thomas J., data for schoolroom ventilation, Feb. 92
Dunham Company announces centrifugal vacuum pump merger, Feb. 108
Dust, the menace of, July 85

Edwards, William D., domestic stokers—their evolution and design, Sept. 60
pressure losses in air ducts, Feb. 69
Effect of enclosures on direct steam radiator performance, new bulletin, Jan. 92
Electric heating of churches, William Sommer, Apr. 65
Electric welding school, Apr. 102
Elliott, F. P., some thoughts on the technique of heating, Aug. 62
training the apprentice and engineer for the heating industry, Dec. 58
Emswiler, J. E., the weathertightness of rolled-section steel windows, Oct. 89
Engineers' licenses in New York State, Jan. 90

Fan, disc, provides exhaust ventilation for large laundry, Jan. 112
Fan standardization, British committee reports on, July 113
Fansler, P. E., studying the heating load, July 108
Fantom radiator, development of the, July 115
Farnham, George D., group heating of industrial plants, January 76
Finance corporation expands, heating and plumbing, Nov. 100
Fire-fighting tests, miniature building for, Mar. 115
Fires, analysis of domestic oil-burner, Aug. 77
Flexibility in heating systems, Charles F. Wolfsfeld, Nov. 67
French journal on heating, new, May 110
Friction of water in elbows, F. E. Giesecke, Mar. 100
Fuel consumption—degree-day method for predetermining, W. R. Abbott, June 75
Fuel consumption, effect of pressure on, Oct. 79, Nov. 83
Fuel costs for two tenants, determining room temperature and proportionate, June 96
Fuels, comparative tests of Canadian solid, in a domestic heating boiler, Sept. 83
Fuels, organization of research committee on, Jan. 96
Furnace and fuel-oil specifications, Apr. 83
Furnace installation must conform to code, Chicago, Mar. 116

Gant, H. P., heating only or air conditioning for the modern plant?, Feb. 94
Garage, heating and ventilation of a large, Edward T. Blaker, June 69
Gas.
A.G.A. dedicates new testing laboratory, Oct. 75
appliance testing code and installation manual, new book, Dec. 83
burning, in coal boilers, Clifford Strock, Nov. 53, Dec. 71
companies, large buildings attract, Jan. 90
conversion installation can be successful, Eugene D. Milener, Jan. 72
conversions featured at A.G.A. convention, Nov. 75
forty-five mile pipe-line electrically welded, June 91
from oil as visualized by a practical engineer, stable, Arthur E. Grant, Jan. 96
great pipe line to serve Denver with natural, Mar. 105
heating a suburban home with, E. C. Uhlig, Oct. 53, Nov. 86
heating a suburban home with gas, correspondence, Dec. 88
heating, data sheets, Nov. 98A, Dec. 98A
heating for the heating contractor, G. C. Carnahan, June 63, July 68, Aug. 58, Sept. 57
insulation committee of the A.G.A. reports on building insulation—what it costs and what it saves, Dec. 79
interests to study coal at the University of Michigan, Mar. 105
New York apartment operates all utilities with, May 101
papers presented at semi-annual meeting A.S.H. & V.E., July 100
report of subcommittee of A.G.A. on converted installations, E. F. Koch, Nov. 78
selling gas service to the architects, Feb. 109
testing central heating plants using gas as fuel, R. M. Conner, Oct. 80
—the awakened giant, Mr. 105
Gas-fired heaters, new installation rules published for, Nov. 81
Glancing backward.
4. International Heater Co., Jan. 116
5. American District Steam Co., Apr. 99
6. United States Radiator Corp., June 107
7. Richardson & Boynton Co., Sept. 91
8. American Blower Corp., Oct. 96
9. Kewanee Boiler Corp., Nov. 92
10. Buffalo Forge Company, Dec. 99
Glasses, new government tests on, transmitting ultra-violet rays, Feb. 106
Grant, Arthur E., stable gas from oil as visualized by a practical engineer, Jan. 96
Graphs and charts, Nov. 85

Haslam, R. T., combustion with domestic oil burners, Mar. 79
Hayes, David B., replacing the old heating plant, July 63, Aug. 67
Heat transmission through walls, standard test code for, Feb. 98
Heat utilization, principles and methods of, Prof. C. H. B. Hotchkiss, Oct. 59, Nov. 61
Heating and Piping Contractors National Ass'n secretaries take stand on important trade questions, Jan. 107
business prospects for 1928, Jan. 107
New York heating contractors adopt seal, Jan. 107
eight local heating contractors' associations licensed to engage in certified heating, Jan. 107
wages and conditions in steamfitting industry, Jan. 108
separate organizations urged for heating and plumbing contractors, Feb. 116
directors hold winter meeting, Feb. 116
appointment of Edward G. Byrd as field man, Feb. 116
plan of training workers proposed by the heating contractors, Feb. 117
San Francisco association formed, Feb. 117
board of directors discuss association activities, Apr. 96
Portland local incorporates, Apr. 96
contractors in nine cities start certified heating advertising campaign, Apr. 96
New York State heating contractors hold annual meeting, Apr. 96
itinerary of heating contractors' field man, Apr. 97
Newark association's annual beefsteak dinner, Apr. 97
officers elected in St. Louis, Apr. 97
plans for the 39th annual convention, May 108
Cleveland heating men on inspection trip, May 108
certified heating campaign to be repeated, May 109
New York City association re-elects officers, May 109
Newark association's beefsteak dinner, May 109
annual meeting of Wisconsin association, June 104
Washington association elects officers, June 104
report of annual meeting at Philadelphia June 4-7, July 87
new officers and directors, July 88
association activities, Sept. 98
board of directors meet, Oct. 100
association secretaries' conference, Oct. 100
twenty cities have certified heating, Oct. 100
certified heating campaign inaugurated in Milwaukee, Oct. 100
New York City association's annual outing, Oct. 100
Milwaukee association desires catalogs, Oct. 100
Oakland association organized, Oct. 100
Cleveland offices moved, Oct. 100
heating contractors organize in San Diego, Dec. 101
Heating.
a modern office building, Apr. 69
a suburban home with gas, E. C. Uhlig, Oct. 53, Nov. 86
air conditioning in a movie theatre, Aug. 64
and plumbing industries institute at Carnegie Tech, Apr. 102
and ventilating a large church school, Mar. 74
and ventilation, American edition of Rietschel-Brabbee's new book, Jan. 92
and ventilation equipment for a kitchenette hotel, June 85
and ventilating equipment prominent in New York power show, Jan. 114, Sept. 81
and ventilating the world's largest auditorium, Jan. 67
and ventilation, effects of building insulation, S. R. Lewis, Feb. 115
and ventilation of a large garage, Edward T. Blaker, June 69
and ventilation, Peter H. Bryce, M.D., Feb. 102, Mar. 97, Aug. 84
and ventilation specifications, Harold L. Alt, Mar. 83, Apr. 74, May 80, July 80, Aug. 72, Sept. 71, Oct. 66, Nov. 69
apparatus, yearly production of domestic, valued at over $200,000,000, Jan. 97
A.S.H. & V.E. engineers review work of the year, Feb. 87
British research board reports on factory heating system, Aug. 71
burning gas in coal boilers, Clifford Strock, Nov. 53, Dec. 71
car repair shops, W. H. Junker, July 72
coldest day may not require most fuel, Oct. 93
combustion with domestic oil burners, R. T. Haslam, Mar. 79
comparison of vapor, water and one-pipe steam systems, July 114
district, the status of, Mar. 87, Apr. 80, May 76, June 72, July 76, Aug. 64
domestic stokers—their evolution and design, William D. Edwards, Sept. 60
effect of enclosures on heat emission of radiators, T. W. Reynolds, Nov. 89
electric, in Seattle, Jan. 111
electric, of churches, William Sommer, Apr. 65
engineering survey of a domestic heating plant, T. H. Smoot, Oct. 81
European practice in low-pressure steam, J. Blansjaar, Apr. 77, May 82
extensions to existing plants will feature next year's growth, July 93
flexibility in heating systems, Charles F. Wolfsfeld, Nov. 67
gas conversion installations can be successful, Eugene D. Milener, Jan. 72
gas, for the heating contractor, G. C. Carnahan, June 63, July 68, Aug. 58, Sept. 57
glancing backward.
4. International Heater Co., Jan. 116
5. American District Steam Co., Apr. 99
6. U. S. Radiator Corp., June 107
7. Richardson & Boynton Co., Sept. 91
8. American Blower Corp., Oct. 96
9. Kewanee Boiler Corp., Nov. 92
10. Buffalo Forge Company, Dec. 99
home-study course in gravity steam and water heating, new, A. M. Daniels
Lesson 29. (cont'd) Jan. 84
Lesson 30. Feb. 81
house heating featured at A.G.A. convention, Nov. 75
house, made possible with new British system, Aug. 57
how they keep warm in Afghanistan, George Cecil, Apr. 93
how to connect a one-pipe system and a vacuum-return system, Sept. 86
how would you do it?, Feb. 104, Mar. 91, Apr. 85, May 98, June 92, July 111, Aug. 83, Sept. 82, Oct. 87, Oct. 93
industry closely linked to successful oil-burner sales, Jan. 95
industry in Canada finds use for conditional sales act, Apr. 92
loads in degree-days, monthly, in New York, Boston, Pittsburgh, Chicago, St. Louis, Minneapolis, San Francisco, Denver, and Seattle, Jan. 106, Feb. 122, Mar. 104, Apr. 92, May 104, June 102, July 108, Nov. 95, Dec. 96
methods of air distribution, L. L. Lewis, Aug. 91
New York University conducts short-term course in plumbing and, Mar. 92
of industrial plants, group, George D. Farnham, Jan. 76
oil heat for the White House, Nov. 82
only or air conditioning for the modern plant?, H. P. Gant, Feb. 94
papers presented at annual and semi-annual meetings of A.S.H. & V.E., Feb. 97, July 102
papers presented at the annual convention of the H. & P.C.N.A., July 87
plants, oil burners for large low-pressure.
6. Petro, Jan. 126
7. Winslow, June 110
8. Simplex, Sept. 99
9. Vesta, Nov. 104
radiation tables, new, May 68
replacing the old heating plant, David B. Hayes, July 63, Aug. 67
R. Davie, Sept. 67
report of subcommittee of A.G.A. on large building heating, Nov. 80
saving on the coal bill by using small size coal, C. F. Smith, Dec. 63
some thoughts on the technique of, F. P. Elliott, Aug. 62
specifications, movement to clarify, Feb. 122

studying the heating load, P. E. Fansler, July 108
the summer White House, Konrad Meier, Aug. 53
theatre air conditioning in the southwest, Everett S. Buck, Feb. 73
training the apprentice and engineer for the heating industry, F. P. Elliott, Dec. 58
tubular electric system used in Great Britain, A. C. Blackall, Aug. 70
12,000,000 railroad passengers served by oil heat, J. L. Bracken, Mar. 69
underfloor water heating system for English schools, Dec. 98
vapor, see vapor heating
water hammer, cause of, in two different heating systems, July 114
welding costs for the heating contractor, John H. Zink, Dec. 67
welding for the heating contractor, Horace E. Wetzell, Oct. 62, Nov. 64
welding in industrial installations, Sept. 84
what is the trend in radiator design?, Konrad Meier, Sept. 53
what pressure steam distribution for tall buildings, Harold L. Alt, Dec. 60
Home-building council to promote rehabilitation movement, national, Apr. 106
Home-study course in gravity steam and water heating, Ara Marcus Daniels.
Lesson 29. (cont'd) Jan. 84
Lesson 30. Feb. 81
Hotchkiss, C. H. B., Prof., principles and methods of heat utilization, Oct. 59, Nov. 61
House heating featured at Atlantic City convention of A.G.A., Nov. 75
How would you do it?, Jan. 99, Feb. 104, Mar. 91, Apr. 85, May 98, June 92, July 111, Aug. 83, Sept. 82, Oct. 87, Oct. 93
Humidity, proper, prevents accidents in dry-cleaning plants, Apr. 97

Illinois Master Plumbers' Association formulates radiation factors for insulated buildings, May 94
Industrial plants, group heating of, George D. Farnham, Jan. 76
Installing oil heat, new book, Aug. 101
Institute Thermal Research, inauguration of, Feb. 101
Insulation.
building—what it costs and what it saves, Dec. 79
building, when should it be used, E. N. Sanbern, Feb. 98
effects of building, on heating and ventilation, R. S. Lewis, Feb. 115
I.M.P.A. formulates radiation factors for insulated buildings, May 94
manufacturers and the A.S.H. & V.E. insulation code, Jan. 112
standard conductivity coefficients for building, Apr. 95
International Heater Company, historical description of, Jan. 116

Japanese heating and plumbing engineers hold convention in Osaka, Sept. 90
Junker, W. H., heating car repair shops, July 72

Kansas City Laboratory issues oil handbook, Nov. 88
Kewanee Boiler Corporation, historical description of, Nov. 92
Koch, E. F., report of subcommittee on converted installations, Nov. 78

Laundry, disc fan provides exhaust ventilation for large, Jan. 112
Legal decisions.
agreement to heat premises and control of plant makes lessee liable for coal hole injury, Jan. 98
breach of heating warranty, proof necessary of amount of damages for, Apr. 88
claim for extras installed without written order disallowed, Feb. 114
cost of repair or installation of heating plant as between co-owners of property, Oct. 98
covenant to heat leased premises—tenant's duty, June 106
electrical air-heating rates, June 106
exeecessive damages, Mar. 93
fire box and chimney parts of heating plant but not of boiler, and not covered by boiler explosion policy, Jan. 98
furnace and pipes, right of conditional seller to tenant of, Aug. 87
furnace, where conditional vendor of property is without knowledge of, installed on conditional sales contract with vendee, Aug. 87
gas house-heating rates, Apr. 88
heater installation contract, authorized change in, Mar. 93
heating company held not liable to owner for defects in thermostats selected and specified by owner, Oct. 98
heating installation, proof of contract with partnership for, Aug. 87
heating plant contractor may sue on quantum meruit instead of on contract, Aug. 87
heating plant, tenant's rights in, erected by him, Feb. 114
heating sub-contractor's lien for extra work under verbal contract with owner under Pennsylvania statute, Feb. 114
lien for heating installation—timely filing, Jan. 98
lien for installation of heating plant contracted for by tenant, June 106
steam heat company held entitled to certificate of authority to issue securities in reasonable amount, Feb. 114
sub-contractor held bound by general conditions prefixed to specifications, Jan. 98
sufficiency of notice by ventilating contractor before action on surety bond, Mar. 93
Lewis, L. L., methods of air distribution, Aug. 91
Lewis, S. R., practical ventilation for schoolrooms, Feb. 91
Lincoln Electric Company's plant, unit heaters in, Aug. 97
Lumber dry kilns, design of, Harold L. Alt, Jan. 101

Market research agencies, Jan. 100
McCornack, W. R., unit ventilators in schools, Feb. 93
McGuire, Samuel A., downward ventliation for an office building, Dec. 53
Mechanical equipment of the world's largest auditorium, Jan. 67
Mechanics for Engineers, new book, Sept. 88
Meier, Konrad, heating the summer White House, Aug. 53, Sept. 53
Midwest power conference, announces fourth, Sept. 90
Milener, Eugene D., gas conversion installations can be successful, Jan. 72
Modernizing.
building volume in Duluth totals 25%, Oct. 84
bureau of the National Building Industries organized, home, May 113
campaign progresses, home, Dec. 90
increased 18% in Philadelphia through sales promotion campaign, Dec. 89
$16,500 worth of heating and plumbing equipment sold in Topeka campaign, Oct. 84

National Association of Master Plumbers hold annual convention at Memphis, Aug. 82
National District Heating Association.
year book of, Jan. 112
announces heating school, Feb. 107
district heating activities during 1927, Mar. 114
information wanted for use in compiling piping code, Mar. 114
district heating school at Purdue, Mar. 114, May 107
program of 19th annual convention, June 105
water heating system, S. F. Delany, July 76
report of annual meeting at Atlantic City, June 12-15, July 93
new officers, July 98
new officers of manufacturers' division, July 99
executive and general committee meetings, Dec. 101
National Trade Extension Bureau.
enlarged program, Jan. 108
changes its name to Plumbing and Heating Industries Bureau, Mar. 92
National Trade Journals, Inc., acquires the Heating and Ventilating Magazine, Dec. 90
National Warm-Air Heating Association.
merger proposed of warm-air furnace associations, Jan. 103
L. W. Arny resigns as director of public relations, Jan. 103
warm-air furnace heating surface defined, Mar. 101
15th annual convention, June 105
better business committee for warm-air heating industry, June 105
applying oil burners to warm-air furnaces, Sept. 94
Nealey, J. B., radiators cast continuously, June 89
New York Commission on Ventilation to make tests in New York schools, Sept. 89
in Syracuse schools, Nov. 100
New York University offers three-year evening courses, Oct. 88
Nicholls, Percy, output-operating characteristics of low-pressure boilers, Feb. 96

O'Bannon, L. S., preliminary boiler tests in Kentucky laboratory, Feb. 96
Oil-burner.
engineering survey of a domestic heating plant, T. H. Smoot, Oct. 81
exposition held at Wanamaker's, Oct. 94
fires, an analysis of domestic, Aug. 77
fundamentals for the dealer, Aug. 88
industry, fifth annual convention imparts sense of stability to, May 85
sales, heating industry closely linked to successful, Jan. 95
taking it to the customer, Sept. 97
wiring practice and precautions in installation, C. P. Packard, Nov. 87
Oil burners.
combustion with domestic, R. T. Haslam, Mar. 79
dealers in convention approve of deferred-payment plan, June 88
for large low-pressure heating plants.
6. Petro, Jan. 126
7. Winslow, June 110
8. Simplex, Sept. 99
9. Vesta, Nov. 104
present accepted practice in domestic.
34. Penberthy, Feb. 127
of today, domestic, Mar. 108, Apr. 103
warm-air furnaces, applying oil burners to, Sept. 94
Oil burning in the British Isles, Jan. 96
Oil company, through application of technical data, extends scope to include installation of heating plants, supply of fuel and servicing of burner, W. R. Abbott, June 74
Oil-fuel distribution analyzed, Nov. 88
Oil fuel specification data sheets, July 114A, Aug. 90A, Sept. 98A, Oct. 98A.
Oil fuel, two-year contracts for domestic, announced by Standard Oil, June 95
Oil Heat—a new journal for the heating industry, Oct. 99
Oil heat for the White House, Nov. 82
Oil heat, 12,000,000 railroad passengers served by, J. L. Bracken, Mar. 69
Oil-heating equipment, evening course in domestic, at New York University, Feb. 113
Oil, stable gas from, as visualized by a practical engineer, Arthur E. Grant, Jan. 96
Oil supply too low, previous estimates of, Oct. 90
Own-your-home exposition sponsors movement for certification of houses, Jan. 128

Packard, C. P., wiring practice and precautions in oil-burner installation, Nov. 87
Patents and patent law, new book, Oscar A. Geier, Oct. 88
Pipe sizes, calculating, J. Blansjaar, Apr. 76, May 82
Pipe welds, characteristics of, Horace E. Wetzell, Nov. 64
Pipecraft, Jan. 82, Mar. 88, Oct. 70
Piping, welding as applied to steam and water, John H. Zink, Aug. 80
Piping in Cathedral of St. John the Divine, welded steam, Jan. 93
Plumbing and Heating Development League.
Philadelphia market for materials studied, Aug. 90
Plumbing and heating development plan, Philadelphia's, Apr. 98
Plumbing and Heating Industries Bureau.
National Trade Extension Bureau changes its name, Mar. 92
intensive campaign for new business in Philadelphia, May 110
inauguration of rehabilitation campaign, May 110
Philadelphia sales campaign, May 110
bureau establishes Pacific Coast branch, May 110
standard test on steam-fitting, new book, May 110
Chicago to be headquarters of bureau, July 99
regional conference on training programs, July 99
bureau increases personnel, July 99
west coast offices established, July 99
bureau will move to Chicago, Sept. 95
bureau appoints new manager for west coast office, Sept. 95
Kansas City to spend $50,000 for modernization campaign, Sept. 95
heating and plumbing contractors' finance plan outlined, Sept. 95
bureau moves to new quarters, Oct. 88
presidents' and secretaries' conference, Dec. 101
Power Show, heating and ventilating exhibitors at and report of, Jan. 114, Oct. 92, Dec. 102
Practical sheet-metal duct construction, William Neubecker, new book, June 91
Present accepted practice in domestic oil burners.
34. Penberthy, Feb. 127
Present practice in vapor heating.
14. Hutchison system, May 111
15. Veco system, Aug. 100
16. Adsco system, Oct. 91
17. Marsh system, Dec. 97
Pressure losses in air ducts, William D. Edwards, Feb. 69
Pressure steam distribution for tall buildings, what, Harold L. Alt, Dec. 60

Prudential Insurance Company sets example by providing adequate air supply for its personnel, Samuel A. McGuire, Dec. 53

Radiation.
concealed, leading up to, Sept. 79
factors for insulated buildings, I.M.P.A. formulates, May 94
New York apartment operates all utilities with gas, May 101
tables, new, Paul R. Babcock, May 68
Radiator.
design, what is the trend in, Konrad Meier, Sept. 53
manufacture, simplification needed in, Harold L. Alt, Feb. 75
ratings on a B.T.U. basis, Harold L. Alt, Feb. 78, A. H. Schroth, Feb. 78
Radiators.
cast continuously, J. B. Nealey, June 89
effect of enclosures on heat emission of, T. W. Reynolds, Nov. 89
installing, in an old residence, David B. Hayes, July 63, Aug. 67
Railroad passenger coaches, ventilation of, Peter H. Bryce, M.D., Aug. 84
Railroad passengers served by oil heat, 12,000,000, J. L. Bracken, Mar. 69
Railway car repair shops, heating, W. H. Junker, July 72
Randall, W. C., aeration of industrial buildings, Feb. 94
weathertightness of rolled-section steel windows, Oct. 89
Ratings, new, for Oriole radiators, Mar. 117
Rectangular, square, and round cross sections, graphic methods applying to, William D. Edwards, Feb. 69
Red Cross roll call for 1928, Nov. 99
Refrigeration as applied to industrial air conditioning, R. W. Waterfill, Sept. 75
Rehibilitation work, Chicago master steam fitters' survey on, June 87
Remote control of ventilation in hydroelectric station, Oct. 85
Replacement campaign, American Radiator Company inaugurates million-dollar, June 94
Replacement the old heating plant, David B. Hayes, July 63, Aug. 67
R. Davie, Sept. 67
Reynolds, T. W., air valve on tube radiation, best location for, Aug. 89
air valve venting mains, proper location of the, Sept. 88
enclosures, effect of, on heat emission of radiators, Nov. 89
equalizing boilers of two different makes, Mar. 99
heat output, offsetting body, Aug. 89
heating systems, comparison of vapor, water and one-pipe steam, July 114
heating systems, how to connect one-pipe and vacuum-return, Sept. 86
smoke stack built of plumbing material does not produce draft, Dec. 87
wall temperatures during heating-up period, Aug. 90
Richardson & Boynton Company, historical description of, Sept. 91
purchases Utica heater plant, Feb. 103
Richmond Radiator Company's production of tubular radiators, J. B. Nealey, June 89
Rochester Gas and Electric Corporation's Lincoln Park Plant, Apr. 80
extention to the Genesee Hospital, May 76
Roof ventilators, public building ventilation with automatic, George D. Beals, Feb. 84
Round, rectangular and square cross sections, graphic methods applying to, William D. Edwards, Feb. 69

Salesmen's code of ethics, Jan. 113
Sanbern, E. N., when should building insulation be used?, Feb. 98
Schmidt, H. W., air conditioning in Wisconsin schools, Nov. 58
School ventilation situation, the impasse in the, Dr. Peter H. Bryce, Jan. 91
Schools, new ventilation tests to be made in New York, Sept. 80
Schroth, A. H.
Radiator ratings on a B.T.U. basis, Feb. 78
Sheet products and manufacturers, directory of, Jan. 108
Smith, C. F., saving on the coal bill by using small size coal, Dec. 63
Smoke-abatement campaign making progress in St. Louis, Sept. 98
Smoke prevention in relation to health, Peter H. Bryce, M.D., Mar. 97
Smoot, T. H., an engineering survey of a domestic heating plant, Oct. 81
Sommer, William, electric heating of churches, Apr. 65
Specifications, heating and ventilation, Harold L. Alt, Mar. 83, Apr. 74, May 80, July 80, Aug. 72, Sept. 71, Oct. 66, Nov. 69
Speller, F. N., corrosion in steam heating systems, Feb. 95
Springfield Steam Company, plant of the, typifies how suburban residence localities are being served, Harold L. Alt, June 72
Square, rectangular and round cross sections, graphic methods applying to, William D. Edwards, Feb. 69
St. Clair Hotel, Chicago, heating and ventilation equipment for, June 85
Standard text on steam-fitting, new book, May 110, Nov. 94
Standardization, progress in, Jan. 94
Standards.
for cast-iron and malleable pipe fittings approved, Sept. 88
for unions approved, commercial, Nov. 84
for steel and wrought-iron nipples, conference approves, Aug. 82
new engineering issued, Oct. 86
Static pressure, dynamic significance of, Dr. George De Bothezat, May 65, June 79
Static pressure, an electrical analogy of, Sept. 86
Steam and water heating jobs, estimating, A. M. Daniels, Jan. 84, Feb. 81
Steam distribution for tall buildings, what pressure, Harold L. Alt, Dec. 60
Steam fitters and plumbers meet at Texas A. & M., Aug. 86
Steam is condensed, how much in a closed steel tank, Mar. 91
Stokers, domestic—their evolution and design, William D. Edwards, Sept. 60
Strock, Clifford, burning gas in coal boilers, Nov. 53, Dec. 71
Swedish trains heated by electricity, Nov. 91

Temperature, chirping of crickets indicates, June 112
determining room, and proportionate fuel costs for two tenants, June 96
new radiation tables, May 68
Test methods for radiators and boilers, Dr. C. W. Brabbee, Feb. 88
Testing central heating plants using gas as fuel, R. M. Conner, Oct. 80
"The next size larger," J. Blansjaar, Apr. 77, May 82
Theatre.
air conditioning calculations for a typical, data sheets, Jan. 98A, Feb. 114A, Mar. 98A.
air conditioning in a movie, Aug. 64
air conditioning in the southwest, Everett S. Buck, Feb. 73
contest, an original design submitted in picture, January 79
to be heated at 55° in London, Oct. 73
Thermal units, the trail of the, Apr. 89
Training the apprentice and engineer for the heating industry, F. P. Elliott, Dec. 58
Tubular radiation, Harold L. Alt, Feb. 75
Tunnel projects follow success of Holland tubes, huge, Oct. 86

Uhlig, E. C., heating a suburban home with gas, Oct. 53, Nov. 86
Underground steam and return mains, installing, Oct. 70
Underwriters' new oil-burner listings, May 93
Unit heaters.
air delivery from, to be studied, Nov. 97
in a power house, June 93
show economy in large one-story factory, Aug. 97
smokegraphs make visible the performance of overhead, Apr. 89
Unit ventilators in schools, W. R. McCornack, Feb. 93
United States Radiator Corporation, historical description of the, June 107
purchases Pacific Steel Boiler Corporation, Mar. 117

Vapor heating, present practice in
14. Hutchison system, May 111
15. Veco system, Aug. 100
16. Adsco system, Oct. 91
17. Marsh system, Dec. 97
Ventilating.
equipment, large field for small, Mar. 115
heating and, a large church school, Mar. 74
heating and, a large garage, Edward T. Blaker, June 69
heating and, a modern office building, Apr. 69
heating and, a theatre in the southwest, Everett S. Buck, Feb. 73
heating and, equipment for a kitchenette hotel, June 85
Ventilation.
and health, Peter H. Bryce, M.D., Feb. 102, Mar. 97, Aug. 84
A.P.H.A. discusses air pollution problems at annual meeting, Peter H. Bryce, M.D., Dec. 84
automobile parking scheme that simplifies, May 99
commission carries on work in Syracuse schools, Nov. 100
disc fan provides exhaust ventilation for large laundry, Jan. 112
downward, for an office building, Samuel A. McGuire, Dec. 53
dynamic significance of static pressure, Dr. George De Bothezat, May 65, June 79
for a moving-picture theatre, January 79
for schoolrooms, S. R. Lewis, Feb. 91, Thomas J. Duffield, Feb. 92
for the U. S. Capitol, Feb. 119, Apr. 95
garage, an unusual scheme for, S. C. Wilson, May 93
heating and ventilation specifications, Harold L. Alt, Mar. 83, Apr. 74, May 80, July 80, Aug. 72, Sept. 71, Oct. 66, Nov. 69
indicator, a unique, Mar. 116
Library of Congress ventilation to be investigated, Nov. 98
principles and methods of heat utilization, Prof. C. H. B. Hotchkiss, Oct. 59, Nov. 61
public building, with automatic roof ventilators, George D. Beals, Feb. 84
remote control of, in hydroelectric station, Oct. 85
test to be made in New York schools, new, Sept. 89
the impasse in the school ventilation situation, Dr. Peter H. Bryce, Jan. 91
unit ventilators in schools, W. R. McCornack, Feb. 93
Violet rays, new government tests on glasses transmitting ultra, Feb. 106

Walker theatre, air conditioning in the, Aug. 64
Warm-air heating, simplified data sheets for, Apr. 105
Warm-air systems—air conditioning in Wisconsin schools, H. W. Schmidt, Nov. 58
Waterfill, R. W., refrigeration as applied to industrial air conditioning, Sept. 75
Weather charts for New York, Boston, Pittsburgh, Chicago, and St. Louis, Jan. 104, Feb. 120, Mar. 102, Apr. 90, May 102, June 100, July 108, Dec. 94
Weather charts showing monthly heating loads in degree-days, in New York, Boston, Pittsburgh, Chicago, St. Louis, Minneapolis, San Francisco, Denver, Seattle, Jan. 106, Feb. 122, Mar. 104, Apr. 92, May 104, June 102, July 108, Nov. 95, Dec. 96
Weathertightness of rolled-section steel windows, the, J. E. Emswiler and W. C. Randall, Oct. 89
Welded materials stand severe test, electronic, June 99
Welded steam piping in Cathedral of St. John the Divine, Jan. 93
Welding.
acetylene association convention features, Dec. 93
as applied to steam and water piping, John H. Zink, Aug. 80
conference to be held at Purdue, Dec. 90
costs for the heating contractor, John H. Zink, Dec. 67
district heating school studies, Oct. 65
for heating plants, Mar. 88
for the heating contractor, Horace E. Wetzell, Oct. 62, Nov. 64
in industrial heating installations, Sept. 84
Wetzell, Horace E., welding for the heating contractor, Oct. 62, Nov. 64
White House, heating the summer, Konrad Meier, Aug. 53
White, James T., an original design submitted in picture theatre contest, January 79
Wilson, S. C., an unusual scheme for garage ventilation, May 93
Windows, the weathertightness of rolled-section steel windows, J. E. Emswiler and W. C. Randall, Oct. 89
Wiring practice and precautions in oil-burner installation, C. P. Packard, Nov. 87
Wisconsin heating and ventilating code, H. W. Schmidt, Nov. 58
Wolfsfeld, Charles F., flexibility in heating systems, Nov. 67
Why build a basement, Oct. 78

Yocum, T. W., new executive of oil-burner organizations, Sept. 94

Zink, John H., welding as applied to steam and water piping, Aug. 80
welding costs for the heating contractor, Dec. 67

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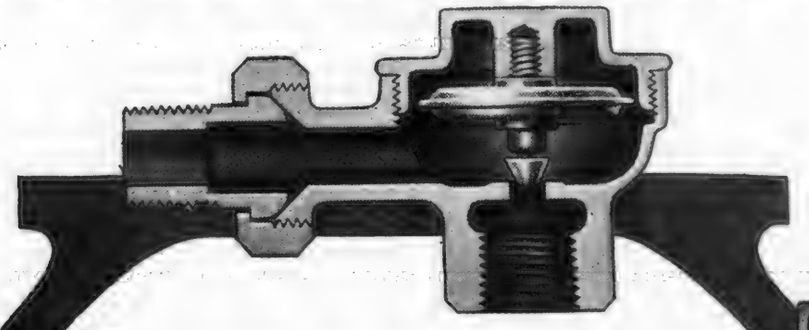

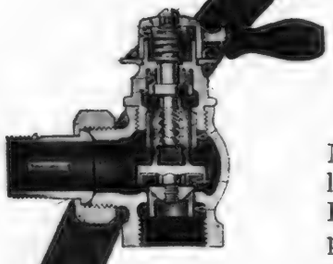

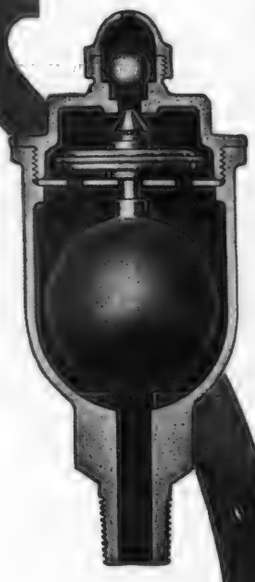

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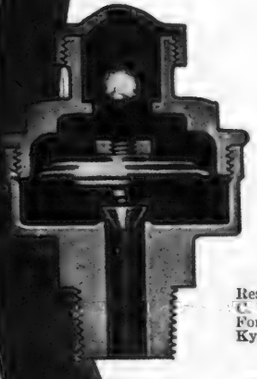

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The Heating & Ventilating Magazine

Volume XXVI — Reg. U. S. Pat. Off. Reg. Canadian Pat. and Corp't Off. — Number 2

Contents of previous issues of THE HEATING AND VENTILATING MAGAZINE *can be found by consulting the Industrial Arts Index at the nearest library.*

Contents for February, 1929

New Data on Heating Effect of Painting Tubular Radiators..... *C. H. Fessenden and Axel Marin* 63
Details of Tests Conducted at University of Michigan with Five Different Paints, including Aluminum, Flat Brown, Flat Tone Cream, Liquid Gold and Vitralite.

Specification Writing for Heating and Ventilating Installations..... *Burritt A. Parks* 68
Part II—Instructions to Bidders.

Welding for the Heating Contractor.....*Horace E. Wetzell* 70
Part IV—Technique of Welding—Line Welds; Branch Welds; Plugs; Bends; Templates.

The Heating Contractor Discovers the Cause of Unsatisfactory Oil Burners .....*David B. Hayes* 73

American Society of Heating and Ventilating Engineers..... 77
Proceedings of the 35th Annual Convention, Chicago, January 28-31.

Selecting and Operating Laundry, Kitchen and Hospital Equipment.. *H. C. Russell* 88
Part I—Laundry Equipment.

The Weather for December, 1928..... 92
New York, Boston, Pittsburgh, Chicago, St. Louis.

Monthly Heating Load in Degree-Days in Nine Typical Cities..... 94

Number of Gas Companies Promoting House Heating Shows Significant Growth 95

How the Underwriters' Laboratories Looks at Domestic Oil-Burning Equipment .....*H. M. Robinson* 99

Boiler Manufacturers Adopt New Testing Code..... 102

U. S. Bureau of Mines Surveys 1927 Fuel Oil Distribution..... 103

Present Practice in Water Heating 105
Thrush System.

Comprehensive Survey Indicates Continued Building Activity in 1929. 107

Standard Heating and Ventilating Data Sheets..... 98A
No. 50F—Gas Heating—Cross Connecting Gas and Coal-Fired Boilers.
No. 50G—Gas Heating—Cross Connecting Gas and Coal-Fired Boilers.

Engineers' Specification Index, Page 168
Advertisers' Index, Page 176

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The Year's Index

AN index, such as that appearing on Page 54, covering the contents of THE HEATING AND VENTILATING MAGAZINE for 1928, is more than a list of references. It constitutes a comprehensive picture of the industry's activities for the past year. Incidentally, the index offers impressive evidence of the wealth of reading matter on subjects directly connected with heating and ventilation which is found suitable for presentation to our readers from month to month.

A. V. Armagnac

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The Heating & Ventilating Magazine

Volume XXVI FEBRUARY—1929 Number 2

New Data on Heating Effect of Painting Tubular Radiators

Details of Tests Conducted at University of Michigan with Five Different Paints, including Aluminum, Flat Brown, Flat Tone Cream, Liquid Gold and Vitralite

By C. H. Fessenden and Axel Marin

From a paper presented at the annual meeting of the American Society of Heating and Ventilating Engineers, Chicago, January 28-31, 1929.

IN the tests here described, which were conducted at the University of Michigan, two identical radiators were installed, as shown in Fig. 1, in such a way that they could be operated in unison under the same conditions. One radiator was left unpainted to serve as a standard of comparison and the other was coated with the paint being investigated.

Each radiator had its own electrically heated boiler and was supplied with saturated steam at constant pressure and therefore constant temperature.

The heat input to each boiler was measured electrically and this heat was all dissipated by the apparatus. Subtracting the boiler and pipe-line loss from the heat input gave the amount emitted by the radiator.

Arrangement of Test Room

The room used for the experimental work has certain characteristics of symmetry as shown in Fig. 2. It is 24 ft. 4 in. by 22 ft. 0 in. and 12 ft. 8 in. high. Only one wall is exposed to outdoor weather conditions and this has two large windows 13 ft. 4 in. apart, center to center. These windows and all openings into the room were kept closed during all tests. The room has no furniture except a table and a couple of chairs.

The two radiators were alike, each being a standard 10-section, 26-in., four-tube, cast-iron, Capitol radiator, having a nominal heating surface of 27.50 sq. ft. and an actual surface of 27.12 sq. ft. The total length of the 10 sections is 25 in. and each section is 6¾ in. wide.

One radiator was installed under each of the two windows in the test room. Instead of resting directly on the floor of the room, each radiator was placed on an 8 ft. by 6 ft. platform 6 in. above the floor to give sufficient elevation for the return lines.

A false wall Beaver board extending up as high as the window sill, behind the radiator, with a 3½-in. air space between it and the brick wall of the building, provided a smooth, unbroken surface from the platform to the window sill, and protected the radiator to some extent from the effects of varying brick-wall temperatures. The radiator stood 2½ in. from the false wall with its top 7 in. below the window sill.

The construction of the boiler is shown in Fig. 3. It is made of pipe and pipe fittings and was enclosed in a wooden box tightly packed with mag-

PROF. JOHN R. ALLEN presented a paper[1] about 18 years ago in which it was reported that paints having a flake metal base when applied to a cast-iron rectangle reduced the heat emission of the radiator as much as 25%. Although the statement frequently has been made that the form and distribution of the surface of the radiator would influence such quantitative data, the erroneous impression seems to be rather widespread that aluminum paint reduces the effectiveness of *any* radiator by about 25%.

A later paper[2] by the same author stated that a 2-col. 38-in. radiator ten sections long, when painted with aluminum bronze, transmitted 200 B.T.U. per sq. ft. per hr., as compared with 240 for the bare cast-iron, a reduction of 16.7%. He further stated that 62% of the 240 B.T.U. transmitted by such a radiator is transferred by convection and the remainder by radiation and that different paints influence only the amount of heat radiated and do not affect the amount transferred by convection.

Some experiments to determine how much of the total heat emitted by a radiator is dissipated by radiation, reported[3] by Allen and Rowley in 1920, include data which show the effects of paints. A 2-col., 13-section, 38-in., cast-iron radiator was used and curves from the data indicate that if the total heat emitted by a clean unpainted radiator is called 100, a coat of aluminum paint will cause the total heat discharged to drop to 88, and a coat of black paint will increase it to 103.

About two years ago, additional data were presented[4] to the A.S.H. & V.E. by Prof. W. H. Severns which support the contention that flake metal paints reduce the heat emission. Quantitative values were given applying to a 3-col., 6-section, Peerless radiator, 32-in. high, with 27 sq. ft. of surface. From his data the following figures showing relative performance are assembled for comparison with the data previously published and with those here presented:

Finish	Relative Heat Emission
Bare iron, foundry finish	100.0
One coat aluminum bronze	90.4
Gray paint dipped	100.6
One coat dull black Pecora paint	99.6

[1]Proceedings, National District Heating Association for 1911, p. 51.

[2]Trans. A.S.H. & V.E., 1920, Vol. 26, p. 19, Heat Losses from Direct Radiation, John R. Allen.

[3]Trans. A.S.H. & V.E., 1920, Vol. 26, p. 27, Radiant Heat Given Off by a Direct Radiator, Allen and Rowley.

[4]Journal A.S.H. & V.E., Vol. 33, p. 23, Comparative Tests of Radiator Finishes, W. H. Severns. (See also The Heating and Ventilating Magazine for February, 1925, New Data on Radiator Finishes and Their Effect on Heat Transmission by William H. Severns, and Heating and Ventilating Magazine Data Sheets Nos. 15 and 15-A).

nesia pipe covering to reduce heat loss as much as practicable.

A Westinghouse heater of the bayonet type was located near the bottom of the boiler in such a position that it was completely immersed in the water.

The steam passed from the upper section of the boiler to the top connection of the radiator and the water returns from the bottom connection, at the opposite end of the radiator, to the lower section of the boiler. Thus a complete circuit was provided and each radiator with its boiler constituted a small, compact heating plant.

The pipe lines were well insulated with hair felt.

Temperature

Thermometers were suspended in the room at the locations shown in Fig. 2, with the bulbs 5 ft. above the floor. There were eight such thermometers and the average of the eight was taken as the "room temperature."

At locations 3, 4 and 8, thermometers also were placed 1 ft. above the floor.

Thermometers also were located so as to give the temperature of the air entering the radiator near the bottom, the temperature of the air 6 in. above the radiator, and the outdoor temperature.

Fig. 1. Set-Up of Electrically Heated Boilers and Tubular Radiators Used in Determining Heat Emission

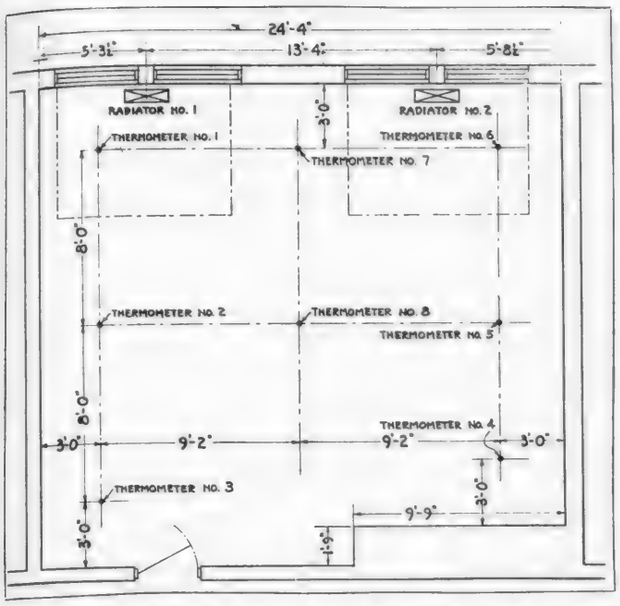


Fig. 2. Plan of Test Room in Which the Effect of Painting Tubular Radiators Was Studied

Heat Supply

Saturated steam was furnished to each radiator by its boiler. The temperature of the steam supplied was maintained constant by means of a sensitive automatic switch controlled by the steam pressure. A rise in pressure and, therefore, in temperature, caused the electric heater to shut off; a drop in pressure caused it to come on.

(The arrangement of the apparatus, which was described in detail in the paper, made it possible to apply heat intermittently to maintain constant-pressure and, therefore, constant-temperature steam).

All the electrical energy supplied to the heater was dissipated as heat by the radiator, pipe lines and exterior surfaces of the boiler. This energy is measured by a special recording portable induction test meter. The recorded revolutions of the meter can be converted into British thermal units. Two such meters were used, one for each boiler.

After obtaining the gross heat dissipated, the valves at the radiator connections were closed, the radiator was vented to atmosphere and the heat loss of the pipe lines and external surfaces of the boiler was determined by supplying heat electrically as before. This heat, designated as boiler and pipe line loss, was subtracted from the gross heat dissipated, to give the net heat emitted by the radiator alone.

Paints Used in Experiments

Five different paints have been used in the experiments, *viz.:*

(*A*) *Aluminum Paint,* manufactured by The Sherwin-Williams Co., Cleveland, O. This paint consists of metallic pigment and a vehicle called bronzing liquid which is essentially a hard-drying varnish thinned down to secure a proper working consistency. It is advertised as a protective, heat- and water-resisting coating for metal surfaces such as gas engines, radiators, hot-water heaters, steam pipes, etc. It gives a bright silver finish.

(*B*) *Flat Brown Paint,* "Mellotone," manufactured by Lowe Brothers Co., Dayton, O. This paint is known as Brown 618. It is designed to produce a flat finish and has the following composition:

	Per cent
Lithopone	30.5
Silica and silicates	20.8
Lead chromate	8.3
Ferric oxide	2.4
Calcium sulphate	4.9
Calcium carbonate	0.7
Carbon	0.2
Linseed oil	10.7
Thinning japan	21.5
	100.0

(*C*) *Flat Tone—Cream.* This paint, manufactured by the Sherwin-Williams Company consists of:

	Per cent
Pigment, by weight	69
Liquid	31
	100

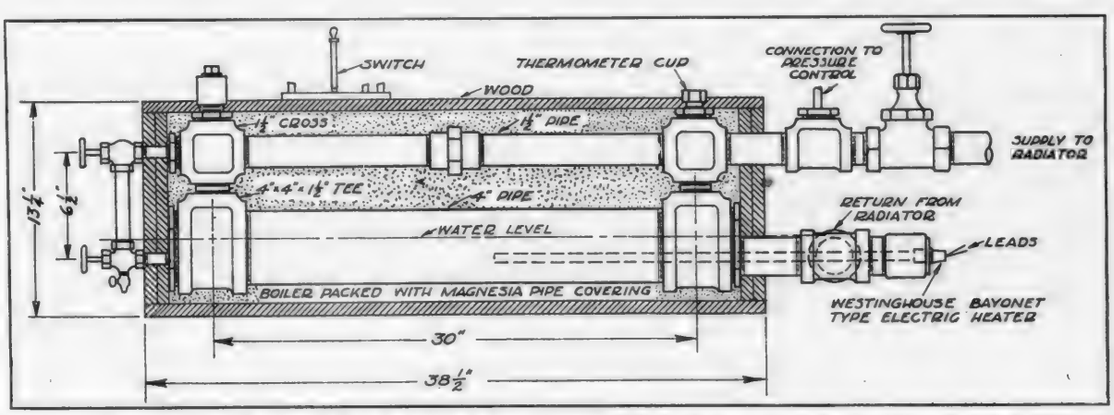


Fig. 3. Electrically-Heated Boiler, Highly Insulated, Supplying Steam to Radiator Under Test

The composition of the pigment is:

	Per cent		Per cent
Lithopone	82	Zinc sulphide	28
Magnesium silicate	18	Barium Sulphate	72
	100		100

Composition of liquid:	Per cent
Linseed oil	29
Drier	14
Mineral spirits	57
	100

(*G*) *Liquid Gold,* manufactured by The Sherwin-Williams Company. The description given above for aluminum paint applies also to liquid gold. It gives a bright gold finish.

(*W*) *Vitralite,* manufactured by Robert Ingham Clark & Co., London, and described as white-gloss enamel.

A surface painted with aluminum paint when magnified 100 times has a rough, irregular appearance, somewhat like the surface of a leveled pile of anthracite coal when viewed from a distance of about 50 ft.

A coating of liquid gold magnified 100 times has the same characteristics of roughness as the aluminum paint, but on account of its color it resembles a closely packed mass of brass shavings.

Flat tone cream paint presents a surface under the microscope which is much smoother than those of the flake metal paints. It has the appearance of cake frosting. Flat brown paint gives a similar surface but a little rougher, like the top of ginger bread.

These surfaces have the same appearance whether the paint is sprayed on or is applied with a brush.

Comments on Tests

Test No. 1 was a preliminary test and, therefore, is not reported.

In Test No. 2 both radiators were unpainted and the performance reported is for clean cast-iron, foundry finish. For Test No. 3 one of the radiators was given a single coat of aluminum paint sprayed on. Preceding the next test a coat of gold bronze was applied over the aluminum. Two tests (Nos. 4 and 5) were made with this finish and then a coat of flat tone cream was added for Test No. 6. Then aluminum was applied on top of the cream for Tests 7, 8 and 9. Test 10 was made with an added coat of brown and Test 11 with white enamel on the brown. Having built up six coats, all of different paints and all sprayed on, it was decided to remove all of the paint and start again on some check tests.

After a thorough cleaning, down to the bare metal, two coats of white enamel were applied with a brush for Test No. 12. Next, a coat of aluminum, followed by brown, then gold and finally cream, each sprayed on, was applied for Tests 13, 14, 15 and 16, respectively.

Heat was kept on the apparatus for several hours preceding any test in order to establish conditions of equilibrium. The actual test was in no case less than 1-hr. duration; usually it was longer. Simultaneous temperatures at the eight 5-ft. elevation seldom differed by as much as 1°. Readings were

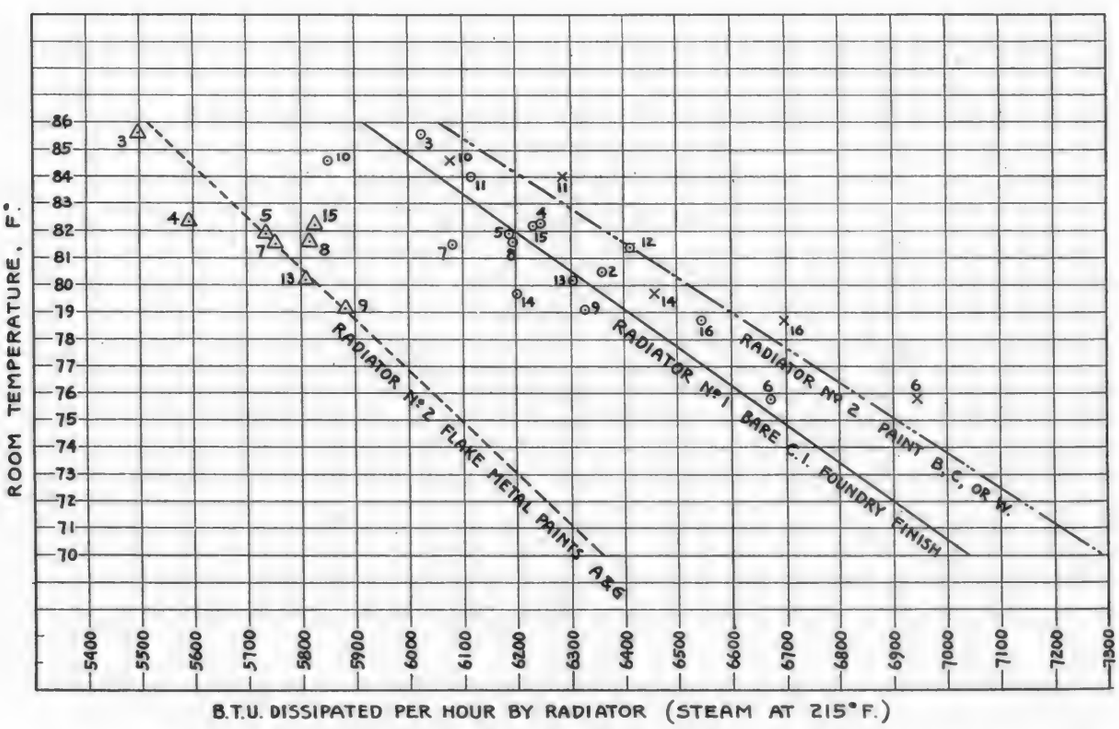


Fig. 4. Graphic Presentation of Tests of Heat Emission of Painted and Unpainted Tubular Radiators

taken at 10-min. intervals, and the test was continued until the meter readings recording the heat input showed consistent results for at least an hour. For further assurance the tests were frequently extended over several hours. The instruments used were calibrated.

Results

Table 1 is a summary of the results. All the tests made, except Test No. 1 are reported. The radiator left unpainted to serve as the standard throughout the tests is designated as No. 1, and the other one which has been given various paint finishes is called No. 2.

The steam temperature was determined from the pressure shown by the combined readings of the barometer, and the manometer on the steam line supplying the radiator. The room temperature is the average of the readings of the eight thermometers located as previously described.

The heat emitted is reported for the temperatures prevailing during the test and is not corrected to a basis of 70° room temperature.

If the conversion factors adopted by the A.S.H. & V.E. are applied to both radiators their relative performance will not be changed.

However, the curves of Fig. 4 which show the heat dissipated per hour plotted against room temperatures are extended to 70°.

Only the final coat influences the heat emission, as evidenced by Tests 5 to 11, inclusive. In Test 5 the finishing coat on Radiator No. 2 was liquid gold and the relative performance 93.5. For Test 6 a coat of cream was added and the relative performance increased to 104.9. On top of the cream a coat of aluminum was applied for Tests 7, 8 and 9, and the relative performance dropped again to 94.6 (average of 95.3, 94.7 and 93.7). When a coat of brown was added for Test 10 the relative performance increased again to 104.7. With white applied on top of the brown for Test 11 the relative performance was 103.6, practically unchanged.

Table 2 is arranged to group the data according to the final finishing coat. The only results that show much disagreement with the others are those for Tests 4 and 12. If Test 4 is omitted and the liquid-gold group included with the aluminum group, the average for all tests with flake metal paints becomes 93.8; if Test 4 is included the average is 93.3. Similarly, if the last three groups are combined, the average, omitting Test 12, is 104.2; if Test 12 is included the average is 103.7.

Fig. 4 shows the heat dissipated per hour plotted against room temperature. The lines converge somewhat for increased room temperatures. Presumably they should curve slightly and join when the temperature of the air surrounding the radiator equals the temperature of the steam, and the heat transfer is zero.

Most of the tests were conducted when the room temperature was in the neighborhood of 80° to 82° F. At 80°, if radiators having the proportions of the ones used in these tests are given a surface coat of flake metal paint, their ability to emit heat will be about 10% less than if the surface coat is one of the colored pigment paints described in this paper. At a room temperature of 70°, taking the values from Fig. 4, the reduction would be about 13%.

TABLE 2. CONDENSED SUMMARY

Test No.	Paint on Radiator No. 2		Relative Heat Emission
2	None		100.0
3	*A*		92.0
7	*A-G-C-A*		95.3
8	*A-G-C-A*		94.7
9	*A-G-C-A*		93.7
13	*W-W-A*		92.9
		Average	93.7
4	*A-G*		90.2
5	*A-G*		93.5
15	*W-W-A-B-G*		94.2
		Average	92.6
6	*A-G-C*		104.9
16	*W-W-A-B-G-C*		103.1
		Average	104.0
10	*A-G-C-A-B*		104.7
14	*W-W-A-B*		104.9
		Average	104.8
11	*A-G-C-A-B-W*		103.6
12	*W-W*		100.8
		Average	102.2

For convenience the kind of paint is designated by its initial letter, such as *A* for aluminum, *B* for brown, *C* for cream, *G* for gold, and *W* for white. The designation *A-G-C-A* means a coat of aluminum followed by a coat of gold, then cream, then aluminum again, making a composite of four successive coats in the order given.

British Research in Thermal Conductivities

UNDER the title "Thermal Conductivities of Walls, Concretes and Plasters," a report is issued by the department of scientific and industrial research of the Building Research Board of Great Britain, under the sponsorship of Sir George Humphreys, chairman of the board.

This technical paper, which essentially is a reprint of Special Report No. 7, was issued in response to a demand for information contained in the original report. The contents include a description of apparatus employed for the tests, together with the details of the methods used in conducting the tests. There is a chapter on temperature measurements and one on measurement of the supply. The guard-ring method was employed in some of the experiments on wall conductivity and in all of the experiments on slab samples. The hot-plate method was used in the case of building materials whose thermal conductivity is of the order of twenty-fold that of cork.

Specification Writing for Heating and Ventilating Installations

Part II—Instructions to Bidders

By Burritt A. Parks

Byron E. Parks & Son, Grand Rapids, Mich.

Submitting Proposals:

"ALL proposals shall be made on forms furnished by the architects or engineers, based on the drawings and specifications and on all revisions and addenda to same. They shall be submitted in sealed envelopes marked 'Bid for .....and with the branch of work bid on clearly indicated on the outside. They shall be delivered to the office of.....at..... on or before.....Standard Time.....'
(date)

Subdivision of Work:

"The mechanical and electrical work will be subdivided into departments as follows:

1. Chimney
2. Heating—including boilers, stokers, etc.
3. Temperature control.
4. Ventilating and sheet-metal work
5. Electric wiring—including clock and signal system, lighting fixtures, telephones, etc.

"Bidders may make tenders on the work in as many of these departments as they desire, but all tenders shall be itemized to show the price for the work in each department and the owner reserves the right to accept the tenders for any of the departments of the work. Note, however, that a contractor shall not be required to accept a contract for any other branch of the work without also being given a contract for that department which he expects to execute himself."

In addition to the above a tender may be made, if the bidder desires, for a combination of two or more departments of the work.

Drawings and Specifications:

"Plans and specifications may be seen at the office of the.....or at the office of the owner, or, upon compliance with the following conditions, they may be taken from the office of the engineers by the various bidders.

"Each bidder taking out drawings or specifications or both shall deposit with the engineers the sum of.....dollars ($.....), in currency, or check made payable to the engineers, to insure the submission of a *bona fide* proposal and the faithful return of plans and specifications in good order, within the time allotted to such contractor for the purpose of bidding on the work entailed by these; which check or cash shall be returned by the engineer to the contractor upon submission of a *bona fide* proposal covering the branch of work bid upon and the return of the plans and specifications, as stated. If the contractor taking out plans and specifications does not submit a proposal at the time and place aforesaid, and the plans and specifications have not been returned to the engineers at least ten (10) days prior to the time specified for receiving bids, the check or cash deposit will be retained as payment for the plans and specifications. Contractors receiving copies of plans and specifications must give a receipt for same and shall return them at once on request."

Explanations:

"Contractors desiring explanations in regard to any part of the work covered by plans and specifications, addenda, etc., previous to the award of contract, shall make written inquiry to the engineer who will make a written explanation, giving copy of all such inquiries with the explanations to each contractor."

Signature:

"The proposal must be signed with the full name and address of the contractor; if a copartnership, the copartnership name by member of the firm with the names and addresses in full of each member, and, if a corporation, by an officer in the corporate name."

Certified Checks:

"All proposals shall be accompanied by cash or a certified check on some responsible bank made payable to the owner for an amount equal to a per cent as below, of the amount of his proposal, as guarantee that should his proposal be accepted, he will within 10 days of acceptance of proposal, enter into a contract and provide bonds, as required, for the faithful performance of this contract.

Under $5,000	10%
$5,000 to $25,000	7½%
$25,000 to $50,000	5%
$50,000 to $100,000	3%
$100,000 up	2½%

"A so-called 'bidder's bond' will not be accepted in lieu of the above deposit."

Return of Certified Checks:

"All certified checks and cash deposits, except

those of the accepted bidder and next higher bidder, will be returned to the rightful owner within 14 days after proposals are opened. The check of the next higher bidder may be held till a contract is closed."

Forfeiture of Certified Checks:

"The successful bidder shall execute a contract and provide bonds as required, satisfactory to owner, within 10 days after written notice that contract has been awarded to him and that sureties offered by him are adequate, sufficient and approved. Contractors properly executing contract and providing bonds as required within the time given, shall have their certified checks or cash returned to them.

"In the event that a bidder refuses or neglects to properly execute contract and provide bonds as required, then the certified check or cash deposit made by him shall be forfeited to and retained by the owner as liquidated damages."

Time of Completion:

"The entire finishing of said work, including all alterations and additions in said contract provided for, or hereafter agreed upon, is to be proceeded with, with all reasonable dispatch, and the same shall be completed and delivered up to the owner, in perfect order and condition, fit for use and occupation, on or before.....except for such extensions of time as may be granted in accordance with Art. 18 of the General Conditions.

"In the event the work under this contract is not completed within the time named by the bidder, a sum amounting to.....dollars, stipulated and agreed upon as and for liquidated damages shall be assessed against the contractor to and for each and every day in which the work remains unfinished beyond the time stipulated for completion."

Names of Sub-Contractors:

"Each successful bidder before signing contract shall be required to give the names and amounts of sub-contractors, if any, whose estimates they have used in making their total bid, and the amounts of their estimates. The responsibility and desirability of sub-contractors will be given due consideration in awarding the contract."

Name of Sureties and Consent:

"Bidders are requested to name in their proposal the surety company which will sign the required bonds in case the contract is awarded, in order that the engineer and owner at the letting of this work may satisfy themselves as to the bonds offered for acceptance. Also, to enclose a letter from the surety company signifying their willingness to furnish the bonds."

Substitutions:

"Bids on the various branches of the work in order to receive consideration must include a tender on the materials, equipment, or apparatus herein specified, but the contractor may submit alternate bids on other goods, equipment, or apparatus which he considers fully equal to those specified, provided he appends the name of the manufacturer, size, style or type of each part that he offers as a substitute. The owner reserves the right to award the contract to any responsible bidder on the materials and apparatus specified, or on any accepted substitutes proposed in the alternate bids submitted as above. After the award no substitution of materials or apparatus for those mentioned in the accepted bid will be permitted."

Openings and Cuttings:

"The general contractor will concrete into the floors and build into the masonry all sleeves or other provision for the passage of pipes through same which may be furnished by the various contractors, together with directions for their accurate placing. The heating, wiring and temperature control contractors must place the sleeves and secure them in position, and cooperate with the general contractor in seeing that they are in proper location when grouted in. If the above contractors fail to furnish the sleeves in time to place them, holes will be cut later by the general contractor and the expense charged to the heating, wiring or temperature-control contractor, as the case may be. All cutting of construction other than masonry shall be done by the general contractor."

Cooperation of Contractors:

"All contractors involved in the construction of this building and the installation of its equipment will be expected to consult and cooperate each with the others to the end that conflictions will be avoided and the entire project result in a complete and harmonious piece of work.

"Piping contractors shall exercise care to avoid conflictions with electrical outlets, locating pipe so as to avoid such conflictions or giving notice far enough in advance so that electrical outlet may be relocated.

"All pipes must be run in such manner as to pass below or above all other pipes which would come in the same plane. This contractor shall confer with other contractors in installing pipes and arrange his work in proper relation to other pipes in the manner approved by the architects or engineers.

"Each contractor whose work is included under these specifications shall examine the architectural, plumbing, framing, heating and wiring drawings before installing the work contemplated in these specifications, and if any discrepancies occur between the drawings accompanying these specifications and the architectural framing drawings he shall report same to the superintendent before performing the work and obtain written instructions for changes made necessary to accommodate the work hereinafter specified. All changes in the work made necessary from the neglect of any contractor to report said discrepancies shall be made by and at the expense of the contractor showing such neglect."

(*Continued on Page* 72)

Welding *for the Heating Contractor*

Part IV—Technique of Welding—Line Welds; Branch Welds; Plugs; Bends; Templates.

By Horace E. Wetzell

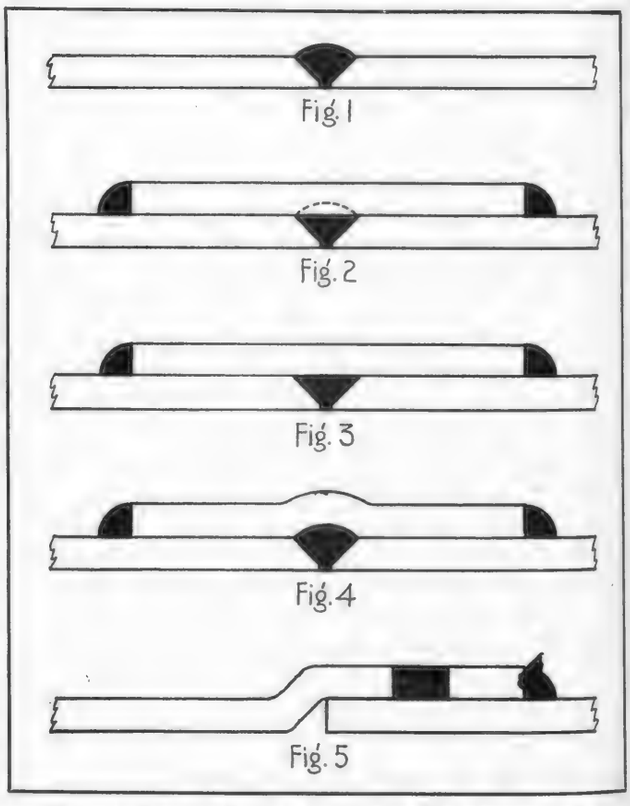
Chief Engineer, The Smith & Oby Company, Cleveland

WITH a knowledge that steel can be welded, pipe joints can be designed to suit practically all conditions met in the building field. Fig. 1 shows the simple butt weld. The pipe should be scarfed in the mill so that the angle between the surfaces to be welded lies between 60° and 90°. A good welder can make this joint 100% efficient. Fig. 2 is a simple butt weld with reinforcing straps welded over the joint longitudinally. The number of straps will be determined by the size of the pipe and the severity of the condition requiring the strengthening. Fig. 3 is a flush butt-weld with a sleeve or collar welded around the weld. This sleeve usually would be in two halves which then would require two additional longitudinal welds. Fig. 4 uses a deformed sleeve so that the sleeve will not interfere with the reinforcing metal. This sleeve will have to be put on in two or more parts. These reinforced butt welds should be used at bends in pipe lines where the bending stress is considerable and also in full-weight lines carrying over 125 lbs. and extra heavy lines carrying pressures above 200 lbs. Fig. 5 shows a method of joining pipe that is becoming quite popular with pipeline companies where their work largely consists in joining length upon length. One end of the pipe is expanded to allow the normal end of a pipe section to slip into it. Not less than four shear holes are placed in this expanded section. Thus the strength of the joint depends upon a lap weld and also on the pure shear strength of the weld metal used to fill the shear holes. The patented Sargol joint shown in Fig. 5A essentially is a flanged joint with one bead of weld metal to assure tightness.

Branch Welds

A simple branch weld is shown in Fig. 6. I believe that the following method of making a branch weld is most desirable. The branch piece is so trimmed that it will make a good fit with the contour of the main pipe. With the branch piece held in the proper position on the main, a chalk line is scribed on the main where the outside of the branch piece meets the main. A hole is then cut in the main, with its edge approximately one-half the thickness of the branch pipe, inside of this scribed line. Therefore, the hole will be a bit larger than the inside diameter of the branch but a bit smaller than the outside diameter. Thus full passage is assured although it will not be possible for the branch to project into the main. The branch is then scarfed to fit the main and finally welded to it. Fig. 6A shows the simple butt weld with reinforcing ribs between the branch and the main. This reinforcement should be used where there is considerable side thrust on the welded branch.

To blank an end of a low-pressure steam-line a piece of plate can be welded into the end of the pipe, as shown in Fig. 7. This method is much more satisfactory than using a flange with a blind flange. For use in high-pressure lines, the round, bull-nose plug, as shown in Fig. 8, is superior. Due



Figs. 1 to 5. Various Methods of End-Welding Pipe

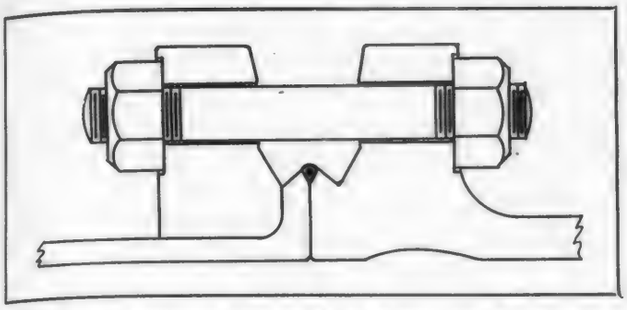


Fig. 5a. Patented Flanged Joint Requiring Minimum Welding Metal

to the round end, this plug readily resists pressure. More welding is required by the bull plug than the plate plug.

Ninety-Degree Turns and Other Joints

Figs. 9 to 14, inclusive, show various methods of making 90° turns in piping. Fig. 9 shows a two-weld elbow. This method is satisfactory in low-pressure, low-velocity steam lines. Fig. 10 is a three-weld elbow which can be used to good advantage in large lines and where friction loss is a factor. Fig. 11 is an ideal method of making a 90° bend. The short-radius pipe-bends are purchased in full 180° units, so that any angularity up to this amount can be cut from the 180° bend. The radii of these bends that are now procurable in sizes up to and including 6 in., are 1½ times the pipe diameter and are about equal to the radii of standard flanged elbows. These bends are not made in the usual way but are forced over a horn-shaped mandrel by hydraulic pressure while gas flames are playing on this part of the pipe. Due to this process, these bends have uniform thickness of wall, smoothness of surface, smallest possible bending radius and absolutely circular cross section. No tangent can be provided on these bends, which occasionally is found to be a disadvantage.

Fig. 12 shows a regular quarter-bend welded into a line. This bend can have a tangent on each end and its radius will be four times the pipe diameter or greater. This arrangement is fine where long radius bends are called for or where the bends are used to take up the expansion in the lines. Methods shown in Figs. 13 and 14 are not to be desired as they will cause excessive friction loss.

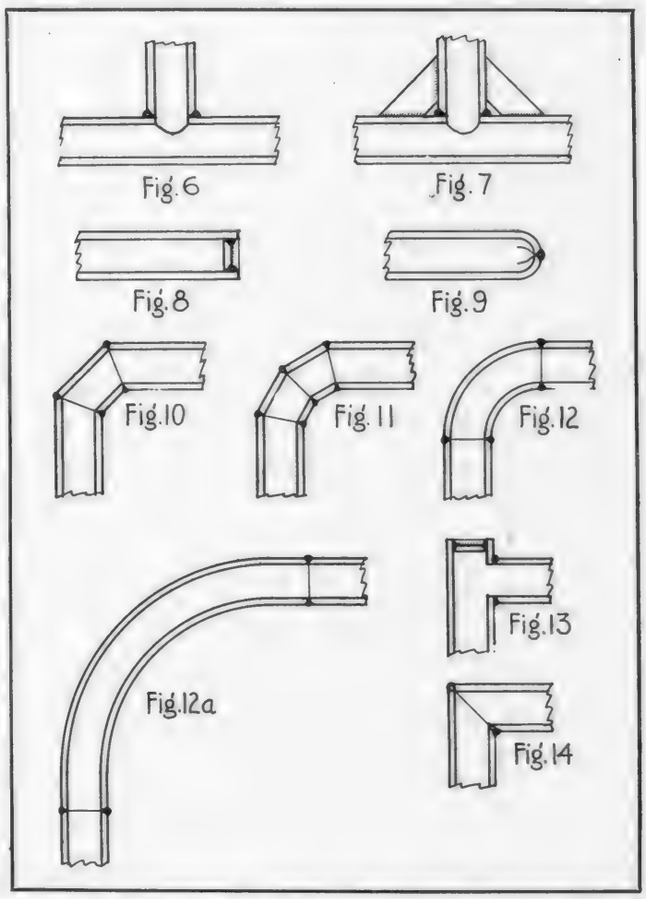
Figs. 15, 16, 17 and 18 show the joining of pipe ends where the pipes are of different sizes. Figs. 15 and 16 are eccentric, while Figs. 17 and 18 are concentric. Upon the relative sizes of the two pipes depends whether the swaged or plate method should be used. Figs. 16 and 18 are swaged. A lateral branch can be made at 45° or at any other desired angle, as shown in Fig. 19.

Where a flanged connection is required, the flange can be welded direct to the pipe, as shown in Fig. 20. In this case the flange must be of forged or cast steel and should be welded inside, as well as outside. A satisfactory joint of this type can only be made by using the electric arc process. In using the oxyacetylene method, too much warpage occurs which would not allow the use of flanges that were already faced and drilled. Fig. 21 shows the standard Vanstone flange. The flanging has been done on a piece of pipe not much more than a foot long and this piece is then welded into the lines.

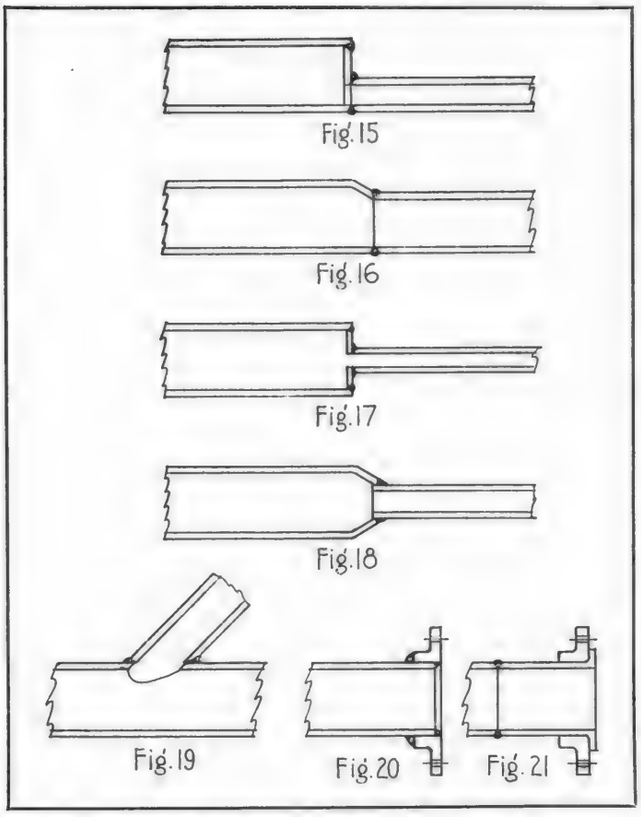
Templates

Templates should be used whenever possible. In cases such as cutting small branches into a comparatively large main, no template is required. If the cut and try method is followed, there is a waste of time and of acetylene and oxygen. Also, there undoubtedly will be considerable irregularity so that the amount of metal deposited at various points of the weld also will vary considerably. The greater the amount of deposited metal, the greater contraction there will be which will produce larger residual welding stress and also misalignment. Every welder should be able to make his own templates. It is wise to have a set of templates of thin metal or heavy tough paper for the joints most frequently used.

Companies constructing their own lines for such services as oil and gas, can gather their engineers about the round table and come to a decision themselves as to whether they should or should not weld. The piping contractor for a building cannot do this. He is installing the pipe under the direction and



Figs. 6 to 14. Schematic Diagrams of Branch and Bend Welding



Figs. 15 to 18. Reducing Pipe Sizes by Welding
Fig. 19. Taking off a Branch at an Angle
Figs. 20 and 21. Welding Flanges

supervision of a mechanical engineer who is employed by the architect of the building. The architect acts as the agent of the owner. The owner could easily be of the type who is not mechanically inclined and who considers welding in the light of a soldering job. The architect and engineer also might be undecided. The contractor who is endeavoring to have welded methods approved might then be told that the good old screwed and flanged way is desired by the owner. Recently, though, progressive architects and engineers are specifying that certain sections of the piping are to be welded. The following excerpts are taken from different building specifications that have been written during the past few years:

1. "Welded joints may be used in place of screwed or flanged joints where approved by the architects. Welding shall be done by the oxy-acetylene method and by experts in this line of work."
2. "The steam main and riser from entrance of building up to loft, together with the horizontal steam main in loft, shall be welded with all screwed or flanged connections welded to same."
3. "Joints in the steam main in the tunnel may be made with couplings, or welded."
4. "Both high and low-pressure piping may be welded at option of the contractor."

In a recent specification for tunnel piping, great detail was given regarding the welded joints. In brief, it specified the joints in the tunnel shall be made by butt-welding the pipe, using either the acetylene or electric-arc process. The type, make and size of welding rod for each process were given. The number, size, and location of reinforcing straps, together with the method of testing and supervising the work were stated in detail. From such a specification it is apparent that the engineer believes in the welded joint and is endeavoring to specify so that he will get good welds. Nevertheless he should not be satisfied until the work is given to a reliable contractor who already has developed a welding organization and who has satisfactorily welded installations to his credit; also all work is inspected by a competent inspector.

The advantages of using welded piping are:
Reduced cost.
Weight of installation reduced.
Strength exceeds that of screwed piping.
Life and resistance to corrosion increased.
Leakage and maintenance minimized.
Saving in cost of covering and in heat loss from uncovered flanges.
Appearance improved.
Eliminates most delays.
Special fittings are made on job.

(*To be continued*)

Specification Writing for Heating and Ventilating Installations

(*Continued from Page 69*)

Temporary Enclosure and Heat:

"In order that the work may proceed without interruption during the winter months the contractor for heating is required by this contract to have the heating apparatus in readiness for furnishing temporary heat at such time as the general construction work on the building may require.

"The general contractor shall furnish such coal as is necessary to heat the building sufficiently to permit the continuance of the work and to properly dry it out.

"The contractor for heating shall furnish at his own expense a competent fireman to have charge of the operation of the heating plant and shall be held responsible for any damage done to same while it is being operated.

"In order to facilitate drying and avoid, as far as possible, the expense of temporary radiator settings, it will be necessary to operate the ventilating plant. The general contractor shall bear the expense of current, oil, etc., for this operation.

"Under this arrangement, until the plastering is completed and radiators can permanently be set, it may be necessary to operate the fan at night and the added expense, if any, shall be borne by the general contractor. Note that radiation will be set in toilet rooms and similar places requiring especial protection.

"Bidder on steam heating shall name in his proposal a price per radiator for setting and connecting same for temporary use."

(*To be continued*)

A Heating Contractor Discovers the Cause of Unsatisfactory Oil Burners

By David B. Hayes

THERE probably is no subject that the heating contractor comes into contact with that is more interesting or complex than the subject of oil burners and their relation to the heating plant.

As a rule, oil burners are sold by a highly trained sales force, educated to paint a beautiful picture of the comforts and conveniences to be had by the elimination of coal, the freedom from ashes and dust, the utilization of the basement as a playroom for the children or as a billiard or card room, and so on. The oil-burner salesman also frequently makes claims that his burner will heat every room in the house to uniform temperature; some even attempt to tell the amount of oil that will be consumed when the prospect relates how many tons of coal he has burned in previous years.

It is safe to say that at least 50% of the successful sales are made to persons who are led to buy through experiences reported to them by friends. No doubt as many that might have been good prospects that are now opposed to oil burners, are the results of the same kind of reaction.

Keep Oil Burners Out of Inadequate Heating Plants

In my opinion it is a grave error for an oil-burner salesman, or the distributor of oil-burning equipment, to accept a contract for the installation of equipment until the heating plant has been passed upon by a heating engineer, or at least by a man of considerable experience in the installation of heating plants. To support these conditions I will relate a few of the experiences I have had in trying to pull some of the oil-burner agents out of trouble due to poor selling by salesmen or by agents.

Here is the case of two unsuccessful sales that lost for both companies what might have been highly satisfied customers. In fairness to all concerned we will call the first burner "A" (a pot-type burner) and the second burner "B" (gun-type).

The salesman for burner "A" had for a prospect a prominent police official in a suburb of a large city. He "sold" his prospect on oil burning on the assumption of *"heating every radiator in his house,* even temperature in all rooms at all times, and once installed your heating troubles are over."

The burner was sold on a small payment down and the time-payment plan. Installation was made and it was a nice looking job, and a good burner. Somewhat to the disappointment of the purchaser the same radiators that he had not heated with coal could not be heated even though he had been assured that "every radiator in the house will respond to our oil burner." Complaints were made, service men were dispatched to make adjustments, the burner was set for a higher rate of combustion, the thermostat was set at a higher temperature, resulting in overheating of many of the rooms. The service men indulged in such hit-and-miss experiments that would come to their minds, the owner becoming more dissatisfied with each call.

Company "B's" salesman was out soliciting business, called on company "A's" dissatisfied customer and listened to the many troubles he had had with his burner and saw a good live prospect. He was invited to look at the plant, and at first glance he observed the burner of a competitor, different in type from the one he sells. He thinks of the commission he will get if he puts across his burner, also the sales argument to be used at some late date—how his burner had replaced so-and-so's—to prove the superiority of his product.

Without taking the time to find out what was causing the trouble, he started off about in this manner—"Well, that type of burner would never heat this big house; what you require is one of our type burners. The principle under which our burner operates is this way, and that way"—and so on. His glib language convinces the owner, and he gets authority to remove "A's" burner and install his own, "that cannot possibly fail to give positive satisfaction," and he gives unconditional guarantee to furnish a burner that *"will give* 100% *satisfac-*

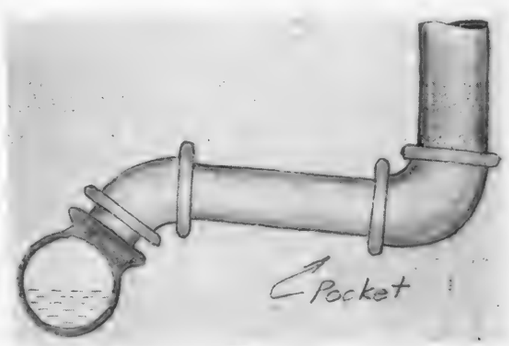


Fig. 1. The Oil Burner Did Not Heat the House but the Trouble Was Due to Faulty Installation of the Steam Piping

tion." The burner was removed and put over in the corner of the cellar—a perfectly good burner, and the new one was installed.

Was the result any different? The second day the complaint came in:

"There are a couple of radiators in the rear of my house that are cold; the rooms are unlivable. You agreed to heat all of my radiators." "B" now has to do what "A" had been doing—furnish service calls. Complaints were frequent. The manager who, by the way, had never had any experience in heating, went to see the owner to quiet him down, and make him believe that the plant would correct itself in a short period. The owner was by this time very much disgusted and had about concluded to go back to coal and save his $600.

Shortly after one of these visits to the police official, the manager and salesman of burner "B" dropped in to a building, where my men were installing a heating plant, to interest the home owner in one of their burners.

I was present at the "sales talk," and among the guarantees offered was the one "to heat every radiator in the building and maintain an even temperature throughout the house." Jokingly I asked them how they could give such a guarantee, as they did not know how the piping was put in, whether the radiation was right, and many other things over which they had no control. I criticized them for trying to sell a burner that way and showed them the probability that grief would result.

The manager then employed me to go over where they were having their trouble with the burner in the home of the police official. When I arrived the burner was operating, making a nice clean fire and everything about the boiler looked good. Before I had a chance to check the job, the owner wanted to know what it would cost to go over his whole plant and see if everything was all right. I explained that it was no small job to check up a house where so many things had to be considered; whether the radiation was correctly figured; if pipes were of the right sizes; if connections were properly made.

To illustrate, I told him I would show him some of the work necessary to check his pipe sizes. So I picked the smallest pipe and shortest main and explained, as I proceeded, each reduction in size of pipe, the necessity therefore, and the relation of one pipe to another. I had gone only a short distance when I turned to the owner and said, "You have a couple of radiators in the rooms above here that are not heating, that is, they *will not heat.* He looked at me in amazement; then told me that those radiators never did give off heat and said that he had been having all his trouble in that end of the house. What had struck my eye is shown in Fig. 1.

I suggested that if he had the man who put in his plant come back and shorten those risers 2 in., he no doubt would have plenty of heat in the radiators fed by these risers or, at least, the radiators would heat up. I asked him why he had "A's" burner removed. He said that it was on account of its inability to heat those two radiators. He admitted that his present burner wasn't heating them, *nor had they ever been heated by coal.*

Then I said to him, "In fairness to the burner you had taken out, in my opinion it is just as good a burner as the one you have in, but neither of them could heat the radiators you complain about until your piping was put in shape."

About a week later I was driving by his place and stopped to make a call to see if his piping had been fixed, and, if so, to see the results. I was not only

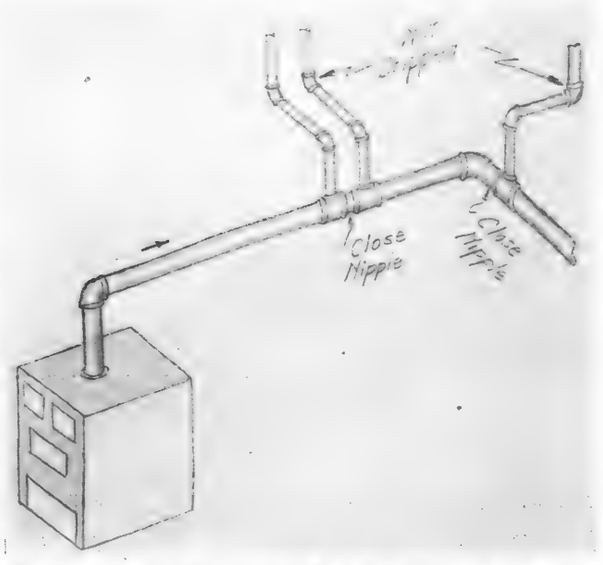


Fig. 2. The Heating Contractor Who Installed this System Did Not Know How to Pipe a Steam System; his Mistakes Were Charged to the Oil Burner—an All-Too-Common Occurrence

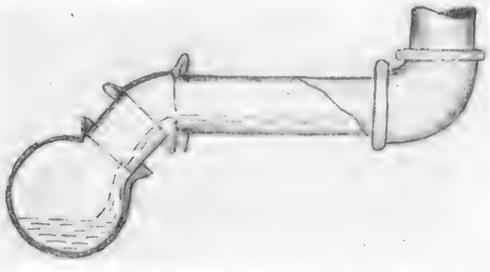


Fig. 2a. The Correct Way

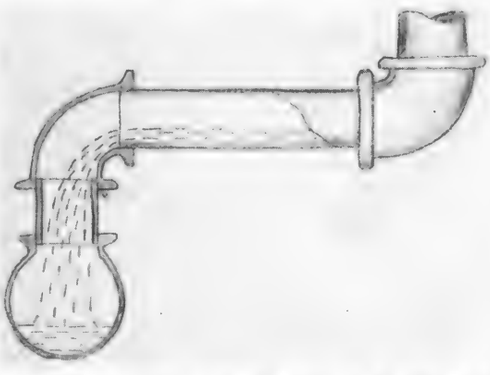


Fig. 2b. The Incorrect Way to Take Off a Riser in a One-Pipe System. The Oil-Burner Engineer Should Be Able to Discover These Evidences of Incompetence on the Part of the Heating Contractor

warmly received but he had a friend who was to have an oil burner installed, and he was not going to make the mistake that the police official made. He wanted me to go over his heating plant and if there was anything wrong with it to fix it up.

I checked up on the job, made a few changes in the piping and also in two radiators, and an oil burner was installed. The dealer for the "A" burner did not sell him a burner because he had not given the police official what he had agreed to—he had made promises that he could not fulfill. The representative of the "B" company could not sell him because he had lied about the "A" burner, had been unfair, had knocked other companies, so the prospect had no confidence in the "B" outfit.

Had either of these dealers had this job looked over before the final order was taken, he would not have installed his burner until the faults had been corrected. Either company would have had a friend rather than a dissatisfied customer. Personally, I have no fault to find with either of these burners. But I can say that I have picked up many a day's work for my men from that endless chain.

The Danger of Predetermining Oil Consumption

To illustrate another point: I recently was called in by another oil-burning agency to find out why "this customer is burning too much oil." This man certainly was "sold" on the principle of oil burning and was willing to pay considerably more for oil than for coal, on account of the conveniences to the women folks who had to tend the furnace throughout the day. The salesman made the mistake of estimating the amount of oil he would burn by using, as a basis, the number of tons of soft coal that had been used in heating (?) his house. This man had a one-pipe steam job. The boiler was covered with less than ½ in. of asbestos cement (cheap grade); all the pipes were uncovered; nearly all of the runouts had been taken off the top of the main; where two runouts were necessary for first and second floors (that is for one radiator over the other) only a close nipple was used between tees, and in every instance where turns in mains were made, a runout was taken off immediately after the ell with a close nipple and tee and the tee looking up. (See Fig. 2.)

I was with the man more than three hours before I could convince him that he was burning no more oil than was necessary *to properly heat his house.* His argument was that he had "heated" his house on 20 tons of soft coal per year at about $8 per ton and now was burning 4600 gals. of oil at 9 cents per gal. The oil-burner salesmen had told him he would not burn over 3000 gals. He was willing to pay the difference between his coal and 3000 gals. of oil, but he knew the oil burner was no good, and started to abuse me on account of the oil burner.

First I was compelled to convince him that I was in no way connected with the oil-burner company, but was employed by them to investigate the conditions as they exist and to report to them. As I had all of the data at hand I was asked to report to the owner. After I had finally got down to plain talk, calling a spade a spade, I showed him that he had never heated his house with coal, and that the 20 tons he had used had heated only *part of his house part of the time.* He would get up in the morning and go down to the heater, break up the soft coal that had caked through the night and open up the drafts; then go back and have his morning shower, and by that time it was necessary to put on some more soft coal. By that time breakfast was ready, and after breakfast the fire had to be stirred up again, and the house was just beginning to get warm. When the time came for him to leave for the office, more soft coal was put on, and the boiler was closed up. It was kept closed until the house cooled off, and then the women folks would go through the same performance provided they were not working in the kitchen.

In the afternoon this same pastime was indulged in to make the house warm for the evening, and at bed time the furnace had to be filled up and closed for the night. He admitted that sometimes in the morning he would find the temperature in the living rooms as low as 50°. He finally admitted that, had he used a thermostat when burning coal and kept the temperature up to the even temperature maintained by the oil burner, he would have burned considerably more coal, so perhaps the difference would not have been great.

As I was leaving his house he said: "I want to thank you for the thorough way in which you went over my heating plant and for the way you have helped me by being so patient in solving this problem. I know that when you have made the changes in my piping and covered my boiler and pipes, I am going to have a better plant and burn less oil."

The next day the salesman who had sold him the burner called on him to find out how I had made out and to see if I had made any headway with him. He was greeted as follows:

"Well, when I have my plant put into shape, I feel I am going to burn less oil, and as long as you are here, you might as well take the order for the other burner that I will put into the new house I am building for my son."

Can you imagine the shock that salesman got?

Before the salesman left this owner handed him a mighty fine piece of advice. "The next time you attempt to tell any one how much oil he is going to burn you had better have that man look over the heating plant and find out whether, with coal, he heated his house all of the time or only part of the time."

I could tell many more incidents of this kind; but I have told only these two to show the relation that must exist between the oil-burner distributors and the installers of heating plants. For intermittent heating you must have fewer defects than you would under constant firing, as they will show up quicker. A burner and heating plant must work together; a poorly constructed heating plant, unless corrected, means an unsuccessful burner sale.

Remember that, from the dissatisfied customer's point of view, "The burner always is wrong."

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ANNOUNCEMENT that the American Society of Heating and Ventilating Engineers is to sponsor a heating and ventilating exposition in Philadelphia next year will be welcome news to many in the industry who have felt that the field was large enough, important enough, and enterprising enough to have a show of its own. THE HEATING AND VENTILATING MAGAZINE has been, and still is, one of that number. As far back as January, 1927, in commenting editorially upon the "Heating and Ventilating Section" of the New York Power Show, THE HEATING AND VENTILATING MAGAZINE went on to say:

> "Two facts stand out prominently as the result of the effort to incorporate a heating and ventilation show in a power exposition. One is that the industry has grown to proportions but little appreciated by outsiders and not wholly realized even by the old-line firms in the business. The other is that any attempt to attach a heating show to that of any other industry won't work. It won't work because their lines are bound to diverge almost from the start. The more progress in the art, the greater the divergence. They talk in different terms. They speak a different language. In short, they don't mix.
>
> "Whatever may transpire this year, or next, it is becoming as plain as day that the heating and ventilating industry will have, and by right should have, an exposition of its own, devoted exclusively to the advances in this particular field. The industry has the importance, it has the strength and it has the 'goods' to put over its own show in a big way."

We predict that the exposition will be a glorious success and that it will attract great throngs of engineers, contractors, scientists and health officials, to say nothing of the lay public which will have the awakening of its life in discovering the comforts, yes, the luxuries, the industry has to offer.

WITH 1930 but a short time away, it is not such a far cry to 1933, the year of another World's Fair in Chicago. Suggestions already are reaching us that the occasion will present another excellent opportunity for the heating industry to be represented in such a fashion as duly to impress the American public. We cannot claim credit for the idea, but we sponsor it just the same, to have at the Fair a "Heating and Ventilating Building," in which demonstrations can be made on a large scale of the industry's achievements with, possibly, the transplanting, for the occasion, of the A.S.H. & V.E. Research Laboratory in Pittsburgh with its experimental rooms, and the duplication of the N.W.A.H.A.'s Research Residence in Urbana. Many other possibilities will occur to us all and it is none too early to start action.

THOSE who have followed the house-heating boiler rating discussion will find plenty to talk about in the announcement of a boiler testing code developed and sponsored by the National Boiler and Radiator Manufacturers' Association. Coming at a time when the American Society of Heating and Ventilating Engineers was about to adopt a revised boiler rating code of its own at its Chicago meeting, the action of the boiler manufacturers assumes unusual significance; among other things it will be taken as a move to discount the society's adoption of its rating code. Be that as it may, we now have the spectacle of an A.S.H. & V.E. boiler testing code, a N.B. & R.M.A. boiler testing code, and an A.S.H. & V.E. boiler rating code. To make the cycle complete, we should hear now that the H. & P.C.N.A. has completed its plans for the adoption of its boiler output code.

Seriously, however, the situation is not beyond the possibility of compromise. A testing code is pre-eminently for the use of the manufacturers and, in the natural course of events, they should be expected to develop their own code. On the other hand, the users, that is, the engineers and contractors, are the ones who make the boiler selections and no amount of testing or rating on the part of the manufacturers is going to affect the users unless such testing and rating meet their conception of the requirements. So with these three elements to consider, the manufacturers, the engineers, and the contractors, it is hard to see how any permanent progress can be made unless they all come together on some mutually-agreeable basis.

Heating Engineers Adopt Boiler-Rating Code

Society's Action Marks Culmination of Many Years' Effort to Establish Basis for Rating Low Pressure Boilers—Results of Co-operative Research Given Prominent Place at Meeting

Thornton Lewis
President, American Society of Heating and Ventilating Engineers

AN action long awaited by the heating engineering world and many times deferred was taken by the American Society of Heating and Ventilating Engineers at its annual meeting in Chicago, January 28-31, when, by an overwhelming vote, the society adopted the low-pressure boiler rating code submitted by its boiler code committee.

The climax came with dramatic suddenness. Alfred Kellogg, chairman of the committee, had presented a revised draft of a boiler-testing code, which was adopted without discussion by practically a unanimous vote. He then presented the draft of the boiler-rating code which the committee had drawn up since the West Baden meeting of the society last summer.

When he came to the rating chart accompanying the report, he interrupted his presentation to permit Director F. C. Houghten, of the Research Laboratory, to explain in detail the operation of the chart. Mr. Houghten gave a typical example showing how performance curves of a given boiler could be plotted and the rating determined directly from the chart. Enlarged copies of the chart in colors were displayed on the rostrum so that the members easily could follow his explanation.

Mr. Kellogg stated that the new code, as drafted, had received the unanimous endorsement of the committee, as well as of the council. Moreover, it was announced before the subject was thrown open for discussion that if the code were adopted, the society would appoint a continuing committee composed of the new chairman of the Research Committee, L. A. Harding; Director of Research F. C. Houghten, and R. V. Frost, whose function it would be to interpret the code and to suggest needed revisions.

Mr. Harding made the motion to adopt the code and W. H. Carrier seconded it with enthusiasm. Dean F. Paul Anderson expressed his intention of voting in favor of adoption and recalled the fact that at West Baden last summer he had been opposed to such action. However, inasmuch as the 700° limiting flue gas temperature has been eliminated in the new code, as well as the section covering boiler selection, he was prepared to support it.

Dr. Charles W. Brabbée then took the floor to urge the members to withhold adoption. He pointed out that 90% of the buyers of boilers are not members of the society, and he emphasized the point that the rating of boilers essentially is a commercial proposition. The proposed code, he added, had not been discussed with the manufacturers, and, therefore, he offered a substitute motion to the effect that the society confer with the boiler manufacturers' association with a view to the adoption of the code after such a conference.

President-elect Thornton Lewis made a strong plea against the motion to postpone, and when the vote was taken, Doctor Brabbée's motion was defeated.

R. V. Frost reviewed briefly the recent history of attempts to establish a boiler-rating code and mentioned the boiler-testing code which has just been adopted by the National Boiler and Radiator Manufacturers' Association. He endorsed the practice of the American Radiator Company and the Richmond Radiator Company of issuing performance curves which, he stated, eliminated the difficulties of boiler selection. The boiler manufacturers' new testing code, he declared, provided for such performance data. H. M. Hart injected a statement to the effect that the Heating and Piping Contractors' National Association never had

abandoned the use of performance curves, but that, as a matter of fact, only two boiler manufacturers had furnished the association with complete performance data covering their boilers.

This brought the discussion to a close and in response to cries for the "question," President Willard called for a rising vote. So impressive was the response that he declared no negative vote would be taken unless there was a demand for it. Following a period of tense silence, he declared the vote to be favorable and the code adopted.

Other high spots of the meeting were the presentation of a number of papers reporting the results of the co-operative research arranged with the various universities through the initiative of Chairman Samuel R. Lewis of the Research Committee. A notable tribute was paid Mr. Lewis at the society's annual dinner, following the Thursday afternoon session, when Toastmaster H. G. Thomas announced that, during Mr. Lewis's absence from his office, it had been completely equipped with a set of walnut furniture presented by the various chapters as a mark of appreciation for his devotion to the Research Committee work.

For the first time in the history of the society, the attendance was sufficiently large for the out-of-town members to have the benefit of the reduced fare based on a minimum registration of 250. As a matter of fact, more than 500 members and guests were in attendance.

Opening Session, January 28

Following a council meeting in the morning and a luncheon for authors and officers, President A. C. Willard called the meeting to order Monday afternoon, January 28, in the ballroom of the Edgewater Beach Hotel. He read a telegram from President-elect Thornton Lewis expressing his regret at being absent, due to illness, and extending his best wishes for the success of the meeting. He then introduced General Chairman H. G. Thomas, of the Chicago Committee on Arrangements, who outlined the entertainment program.

Oliver H. Prentice, general sales manager of the C. A. Dunham Company, but speaking for the Chicago Association of Commerce, extended the city's welcome. At the conclusion of his remarks he called attention to the proposed World's Fair in Chicago in 1933, marking the one hundredth anniversary of the founding of Chicago.

President Willard proceeded at once with the business of the meeting, although he stated that at a later session he would have some thoughts to express in lieu of his expected address.

New Officers

President, Thornton Lewis, Philadelphia, Pa.; first vice-president, L. A. Harding, Buffalo, N. Y.; second vice-president, W. H. Carrier, Newark, N. J.; treasurer, W. E. Gillham, Kansas City, Mo. Members of the council:

Three-Year Term

E. B. Langenberg, St. Louis; Prof. G. L. Larson, Madison, Wis.; F. C. McIntosh, Pittsburgh, Pa., and W. A. Rowe, Detroit, Mich.

For the tellers, Chairman E. N. McDonnell reported the election of the ticket proposed by the nominating committee, as above.

Before proceeding with the technical program, President Willard introduced P. D. Close, the new technical secretary of the society, who was warmly welcomed.

Only one paper was scheduled for the Session, entitled "Heating with Steam Below Atmospheric Pressure." It was presented by the author, C. A. Thinn, chief engineer of the C. A. Dunham Company.

Heating with Steam Below Atmospheric Pressure

This paper briefly recounted the advantages of so designing and operating a heating system that the variation in steam temperature can be extended over a much wider range than in the conventional steam pressure or vacuum system, and of automatically varying the steam temperature in accordance with the outdoor temperature. Mr. Thinn then described the salient features of the Dunham differential system and presented a comprehensive study of the cost of heating a large office building during the 1927-28 heating season.

"In Chicago," said Mr. Thinn, "the estimated figure of 500 lbs. to 600 lbs. of steam per square foot of direct radiation per season is a commonly accepted standard.

"These figures, it is believed, are reliable averages. On this basis and from test experience, it is estimated that 450 lbs. per year represents good performance of a vacuum return line steam heating system in a Chicago office building and about 650 lbs. or even 700 lbs. per sq. ft. of radiation per year to be the performance of the more inefficient systems. No fixed figure can be set for the steam consumption of a system because of variation in building construction, heating system design and installation, hours of occupancy, nature of use, varying weather, etc. Therefore, reliable comparisons can be made only by comparative tests performed on the same building.

"By use of steam at varying pressures below atmosphere, the Dunham Building in Chicago, having 7704 sq. ft. of direct radiation, was satisfactorily heated to an average temperature of 70.8° during the past heating season (October 1, 1927, to May 31, 1928) with a steam consumption by meter of 298.8 lbs. of steam per square foot of radiation for the eight months. The average vacuum carried in the radiation was 16.9 in., which gives a corresponding steam temperature of 172.7°. A base temperature of zero was used in calculating the radiation, so the radiation installed is not in excess of actual needs. The building was fully occupied during the heating season and the tenants were permitted to make such use of window ventilation and control of radiator inlet valves as they desired."

Heating the Barlum Tower, a 40-story office building in Detroit, Mich., is an example of the use of steam below atmospheric pressures. This building was completed in September, 1927. Eighty-five per cent of the total 48,000 sq. ft. of direct radiation was turned on during the past season, giving 40,800 sq. ft. in use. Table with Fig. 5 gives a summary of the cost of heating this building. Steam was purchased from a central station heating company. The pressure and temperature chart from a recording instrument located on the 15th floor is shown in Fig. 5 to illustrate the pressure carried and temperature maintained with the outside temperature as indicated on the chart. This chart is self-explanatory.

An industrial plant in Providence, R. I., having 6022 sq. ft. of equivalent radiation made a fuel saving of 33-1/3% when a comparative test was made during two successive weeks when operating the plant with steam below atmosphere as compared with vacuum return line steam system operation.

A high school in Colorado made a saving of 38.8% in tons of lignite coal required to heat the building with steam below atmospheric pressure during the past heating season as compared with a vacuum return line steam system in use the previous season. This school has a total of 4967 sq. ft. of direct radiation. In this and the previous cases, proper comparison has been made by reducing the data to fuel or steam used per degree-day.

A hotel in Tacoma, Wash., having 11,000 sq. ft. of direct radiation, made a saving of $1428 in cost of central station steam used for heating during the first six months of 1928, by using steam at varying pressures below atmosphere as compared with the same period during 1927, when they used a vacuum return line steam system. The

temperature being 0.9° higher during this period in 1928 than in 1927.

These figures reveal a few cases where savings have been made and the large buildings provide the same opportunity for savings as do the smaller buildings.

A lengthy discussion ensued, indicating the lively interest in the use of varying steam pressures to control room temperatures. John F. Hale called attention to the fact that the Osborn system of 25 years ago utilized a vacuum on the supply line and a higher vacuum on the return, which could be varied, thus embodying the principle of steam circulation at varying degrees of vacuum.

Other speakers made the point that the savings mentioned by Mr. Thinn were due to the control of the room temperatures and that thermostatic control of the radiators would be equally effective. On this point Mr. Thinn replied that intermittent heating was not as satisfactory as continuous heating at different temperatures.

L. A. Harding asked if identical results could not be obtained with a forced circulation water heating system having a similar method of control. Mr. Thinn's reply was that with a water heating system the radiators would not warm up or cool off so rapidly.

Referring to the savings mentioned in the paper, one speaker suggested that the new technical secretary of the society, P. D. Close, be detailed to make a survey of buildings in which such systems were installed, and check the figures.

How to insure tight systems, including the holding of a vacuum on the boiler was discussed, Mr. Thinn maintaining that the average installation will become tighter with use. "If this were a factor," he said, "what would happen in buildings equipped with water heating systems?"

Dean F. Paul Anderson thought there was such a thing as having too close a margin in the heat supply as frequently it was desirable to open windows for a time in hotels and such buildings without feeling that the rooms would not quickly warm up again. As far as fuel consumption is concerned, he called attention to the fact that but little more fuel is required to supply steam at 10 lbs. pressure than at atmospheric pressure.

President Willard called on Henry B. Gombers, secretary of the Heating and Piping Contractors National Association, who responded with a greeting from that organization. He also noted the presence of five past presidents of the society, Samuel R. Lewis, Dr. E. Vernon Hill, John F. Hale, Jay R. McColl, Dean F. Paul Anderson and J. I. Lyle.

The session closed with the report of the council which outlined briefly the activities of the past year, including the formation of the Indiana Chapter. Special attention was called in the report to the next annual meeting of the society in Philadelphia, in January, 1930, at the same time that the International Heating and Ventilating Exposition will be held in the Commercial Museum, in that city.

Morning Session, January 29

Secretary A. V. Hutchinson, in his report, reviewed the principal activities of the society during the past year, including the formation of the Pacific Northwest Chapter in Seattle, and the Indiana Chapter in Indianapolis. He reported that both a boiler testing code and a boiler rating code would be presented at the present meeting. The unit heater manufacturers, he stated, have a testing code under way which probably will be ready for presentation at the next semi-annual meeting of the society.

For the finance committee, Chairman W. T. Jones, presented a report which showed the excellent condition of the society, particularly with reference to the publication of the *Guide*.

In introducing the first speaker of the session, President Willard called attention to the new era in which we are living with regard to heating practice. The rules of the past, he said, in many cases no longer apply and we must develop new data in connection with the many new types of equipment that are coming on the market. This condition, he felt, would continue to exist for many years to come so that we have before us a continuing field of inquiry in connection with the latest advances in the art.

Prof. A. P. Kratz then presented a paper on "The Investigation of Heating Rooms with Direct Steam Radiators Equipped with Enclosures and the Shields," by A. C. Willard, A. P. Kratz, M. K. Fahnestock and S. Konzo.

Investigation of Heating Rooms with Direct Steam Radiators Equipped with Enclosures and Shields

The data presented in this paper were obtained in connection with an investigation now being carried on by the Engineering Experiment Station of the University of Illinois in cooperation with the National Boiler and Radiator Manufacturers' Association and the Illinois Master Plumbers' Association, under the supervision of Professor Willard. This paper constitutes only a partial summary of results which, in complete form, will be presented as Engineering Experiment Station Bulletin No. 192 by the University of Illinois.

The primary object of the tests now under way is to determine the effect of various types of commercial radiator enclosures, shields and covers on the heating effect produced and the steam condensed by a cast-iron radiator placed in an actual room subjected to zero weather conditions. Previous radiator tests, according to Bulletin No. 169 by the University of Illinois Engineering Experiment Station, were confined to the study of the heat emission or steam condensing of bare and enclosed radiators under laboratory conditions. Professor Kratz stated that the correlation of the results of the previous investigation with this study is entirely satisfactory.

In the tests under consideration two test rooms were set up with a refrigerator, the temperature of which would easily be maintained at temperatures below zero. Conventional wooden construction was followed in building the interior test rooms, and the radiator placement and hangings were those that might be found in the home. An interesting provision was the arrangement of an attic space and a basement space above and below the test rooms with provision for heating them through shaded electric light bulbs or cooling them to any desired degree, so that the effect of warmed or cooled floors and ceilings could be studied.

Specially built oscillating electric fans were so located that wind movement on the building wall could be simulated. An elaborate system for weighing the condensate was devised and provisions were made to study the movement of air by means of smoke bombs. The radiators first were set up without covers and tests showed that, with an air temperature of 69.4° F. at the breathing level in the west test room and a mean temperature of 216.5° F. in the bare radiator, the net weight of steam condensed per hour was 5.44 lbs. Under these conditions the temperature of the air 3 in. above the floor was 54.3° F. and that 3 in. below the ceiling was 76.1° F., or a difference of 21.8° F. A fairly uniform temperature gradient in the air from floor to ceiling was obtained. With 69.5° F. at the breathing level the whole zone below the breathing level, which may be regarded as the living zone, was too cool for satisfactory comfort. The high temperature at the ceiling resulted in an excessive heat loss through the ceiling itself.

The catalog rating for the type of bare radiator used, based on the engineering standard of 240 B.T.U. emission per sq. ft. per hr. with steam at 215° F. in the radiator and air at 70° F. surrounding it, was 21 sq. ft. The actual superficial area of the radiator by measurement was 19.7 sq. ft. The total heat emission under the test conditions, based on steam at 216.5° F. in the radiator and a temperature of 69.4° F. at the breathing

level, was 5.44 x 969.1 = 5270 B.T.U. per hr. Hence, the total heat emission under standard rating conditions would be $5270 \left(\frac{215 - 70}{216.5 - 69.4} \right) 1.3 = 5350$ B.T.U. per hr., and the rating as determined from these tests should be $\frac{5350}{240} = 21.5$ sq. ft. based on the engineering standard as compared to 21.0 sq. ft. given as the catalog rating. Therefore, the catalog rating is approximately correct if the radiator is used in a room with an air temperature of 70° F. at the breathing level, and a steam temperature of 215° F.

In comparing the performance of the enclosed or shielded radiator with that of the bare radiator, Professor Kratz pointed out that several factors must be taken into consideration, and these, he said, are: (1) the effect on the temperature at the breathing level, (2) the effect on the temperature at the ceiling, or the difference in temperature between the floor and ceiling, (3) the effect on the mean temperature in the living zone, or the zone below the breathing level, (4) the relative steam condensation per hour. In general, an enclosure may be regarded as better than the bare radiator if (1) a breathing level temperature within 1° F. above or below 69.4° F. was maintained, (2) if the temperature at the ceiling was lowered, (3) if the floor temperature was maintained equal or raised, (4) if the mean temperature in the living zone was raised and (5) if the steam condensation was the same as, or less than, that of the bare radiator.

To indicate the practical value of these tests, Professor Kratz pointed out that the performance of one type of enclosure was far from satisfactory. In referring to it, he said: "The steam condensation was very much reduced over that of the bare radiator. This reduction can in no sense be regarded as an economy, however, because the enclosed radiator failed to heat the room. All of the air temperatures in the room were from 4 to 5° F. lower than those obtained with the bare radiator. This condition is particularly objectionable near the floor and in the living zone as shown by the air temperatures in this zone. The results with the snugly fitting enclosure were slightly better than those for the one with large side clearance. This seems to indicate that on the whole large clearances are undesirable."

Professor Kratz then went into detail regarding the different tests with enclosures of various types, each of which presented a special problem and produced corresponding results.

Following the presentation of written discussions from John Howatt, chief engineer of the Chicago Board of Education, Prof. E. H. Lockwood of Yale University and H. E. Longwell, Dr. Charles W. Brabbée took the floor to present a number of lantern slides based on test data obtained on the Fantom radiator at the American Radiator Company's Institute of Thermal Research and elsewhere, which corroborated the points brought out in the paper with special reference to the inadequacy of condensation as a criterion of a radiator's heat output. The tests made at the University of Illinois, he said, confirmed the point he had made at previous meetings to the effect that useful heat is the proper basis for judging a radiator's effectiveness. The investigation, he declared, which had just been concluded is more evidence that we are definitely in the "Era of Useful Heat," in which the comfort effect of the radiation will have first consideration.

The presence of H. M. Hart, another past president of the society, was noted by the chairman. Mr. Hart responded briefly to the greetings of the members.

Another paper, representing the character of research on heating subjects which is being conducted at various universities, was on the subject of Experiments on the Effect of Surface Paints on Radiator Performance," by C. H. Fessenden and Axel Marin. This paper is presented on Page 63 of this issue.

Afternoon Session, January 29

Tuesday afternoon was given over to the cooperative research conducted by some of the universities and the Research Laboratory of the society.

Samuel R. Lewis opened the session with a report of the research committee. He stated that, due to the many research undertakings, the society is no longer in the position of seeking papers but had plenty of material for its programs. The five-year pledges, under which the laboratory has been operating, are no longer being solicited but, instead, the manufacturers and others are being asked for one-year pledges. So far, said Mr. Lewis, the response on the part of the manufacturers is more than gratifying so that the two-fifths of the members' dues which go to the Research Laboratory has been matched, dollar-for-dollar, by the manufacturers. Already the 1929 expenses of the laboratory are largely provided for, while the reserve fund of $10,000 has been kept intact and $5,000 set aside for the endowment fund. Mr. Lewis made an appeal for further subscriptions on the part of the chapters to increase the endowment fund.

He called attention to the formation of the Association for Correlating Thermal Research which has been established at the Bureau of Mines in Pittsburgh. An index has been prepared on practically everything that has been published in the field of heating and ventilation, all of which is available to the members.

Up to date, reported Mr. Lewis, eleven educational institutions are cooperating with the committee, in addition to the Bureau of Mines and the U. S. Weather Bureau. One of the latest investigations is that undertaken by Washington University in St. Louis on the subject of garage ventilation. At Yale University the work is being confined to a study of combustion, including oil burning. In addition to this program, the health departments of thirteen cities are studying such problems as dust and smoke, the effect of ultra-violet rays and the causes of hay fever.

Mr. Lewis expressed the pleasure he had experienced in his two years of service as chairman of the committee on research and declared that the work had been one of keen enjoyment, due largely to the splendid cooperation of the other members of the committee. He introduced the new chairman, L. A. Harding, as a man well qualified to carry on the work of the committee, calling particular attention to Mr. Harding's long service as chairman of the committee on code of minimum requirements for heating and ventilation.

Mr. Harding acknowledged the greetings which followed Mr. Lewis's announcement. Mr. Lewis then assumed the chair and introduced Prof. F. B. Rowley of the University of Michigan, who presented an exhaustive paper on "Thermal Resistance of Air Spaces." Mr. A. B. Algren was a co-author of this paper.

Thermal Resistance of Air Spaces

This paper presents the results of cooperative research between the University of Minnesota and the society on the determination of thermal resistance of air spaces. Following an elaborate study of the subject, using six different materials, the author found that:

"There are several factors which affect air space coefficients. These are width of air space, mean temperature between surfaces, condition of surfaces and the ratio of the area to thickness of air space. The effects, due to width of space and mean temperature, should be the same for all surfaces. The surface effects will be different for different classes of materials, although in many cases it should be possible to group materials having similar characteristics. The effect of ratio of surface area to thickness

will be more pronounced for small ratios, and it is probable that for average building constructions it may be neglected.

"In these experiments the air space coefficients were determined for different widths of air space and different mean temperatures. The surfaces used were Insulite, Masonite, Flaxlinum, Celotex, Compo board and Gypsum board, the last two being paper covered. The limiting areas of the air spaces were 9 in. square for the hot plate and 36 in. square for the hot box. As will be shown by the results, the thickness of space and mean temperature both had an effect on the air-space conductance. The surfaces of the materials used all had similar characteristics and the air-space values on the hot plate checked exactly with those on the hot box. It is, therefore, probable that the data and curves shown will apply to all materials with surfaces similar to those specified and for air spaces used in practical building construction. Additional materials are being checked but data, at present, are not available.

"In order to get the points representing resistance in the region of small air-spaces, curves were plotted as extensions of those determined by test. Theoretically all curves for air space resistance should pass through the zero point as the resistance of a zero air space will be zero. Some question might be raised as to the accuracy of this assumption, due to the fact that the air space as taken is a combination of surfaces and air space and that with zero air space there would still be the surface resistances. However, all of the curves drawn through the tested points were directed toward the zero point. In all cases the curves include points of air spaces for widths as low as 0.128, and in the case of the 60° F. mean temperature, a test was made with an air space of 0.051 in. This point checked exactly with the curve as drawn. While some question may be raised as to the point passing exactly through zero, the curves would indicate that this is the case and that the real surface resistance is a very small factor as compared with the air space resistance. As the curves are extended to the thicker air spaces, they approach horizontal lines. There is no definite point at which the maximum resistance of the air space is reached, but apparently the real effectiveness ends at from 0.7 in. to 0.8 in."

Other research papers presented at this session were "Additional Coefficients of Heat Transfer as Measured under Natural Weather Conditions," by F. C. Houghten, Carl Gutberlet and C. G. F. Zobel; and Air Infiltration through Various Types of Brick Wall Construction," by G. L. Larson, E. W. Nelson and C. Braatz.

Additional Coefficients of Heat Transfer as Measured under Natural Weather Conditions

Mr. Houghten described the results of a supplementary study on a number of types of construction, following the procedure previously developed. This involved the use of the Nicholls heat flow meter to measure directly the rate of heat flow through the walls. The tests made were upon several forms of wall construction and upon concrete floor and a prepared paper shingle roof. In general the results checked with those secured in earlier laboratory reports and with standards given in the *Guide*. In several instances the type of construction differed, resulting in the development of new data for these constructions. Where the coefficients were found not to be in agreement with accepted standards the discrepancies usually were accounted for by variation in construction. The conductivity of concrete was the only case showing marked discrepancy between measured and computed values, indicating that the coefficients used in the past may be too low and the heat flow through concrete walls of different mix and aggregate should be the subject of further study.

Air Infiltration Through Various Types of Brick Wall Construction

The paper read by Professor Larson deals with research carried on at the University of Wisconsin under the sponsorship of the society with the intention of deriving more definite information relative to air infiltration occurring through plain 13-in. brick walls. In a measure it supplements research recorded in a paper on the effect of frame calking and storm windows, the results of which were presented at the last semi-annual meeting. The writer described the set-up of test apparatus, which consisted of a large air-tight chamber, across the middle of which was interposed the wall to be tested. Air pressure was produced on one side of the wall by means of a small motor-driven blower and the amount of air which filtered through the walls was measured by passing it through an orifice mounted at the end of an extension to the chamber end opposite the blower. Two types of brick were used in the construction of the walls, a hard-face brick and a more porous type, commonly known as Chicago clay brick. Three of the walls were built up with a cement-lime mortar, the other two with a good lime mortar. The walls were so built as to differentiate between good and poor workmanship. This term was defined as only the manner of using the mortar. In the former case the spaces between the bricks were completely filled with mortar through the thickness of the walls, resulting in a wall practically free from voids. In poor workmanship very little mortar was used between the two outside faces of the wall, although the outside appearance of the walls was the same.

Each of the walls was subjected to wind pressure corresponding to a range of wind velocities from about 5 mi. per hr. to 30 mi. per hr. After about five months had elapsed from the time of construction each wall was subjected to eight complete tests over the same velocity range and two months later the tests were again repeated in a similar manner. A great many interesting data were secured pointing to definite conclusions in regard to infiltration and its predetermination. For instance, it was found that there was a greater variation in infiltration between the good and poor walls built of porous brick than between those built of hard brick. Also it was found that the same grade of workmanship results in more leakage through cement-lined mortar joints on porous brick than on hard brick. This probably can be attributed to the drying-out effect due to the porous brick absorbing moisture from the mortar during the setting process, opening the pores of the mortar, or causing the mortar to shrink away from the brick surfaces and preventing a proper bond. This conclusion would indicate that, to secure the same infiltration through mortar in a porous brick wall as in a hard brick wall, additional care in workmanship will be required to the extent of soaking the bricks before laying. A suggestion to test individual bricks was looked upon unfavorably because of the minute quantities of air involved and of the wide variation in leakage characteristics.

In concluding, the writer suggested many interesting and valuable supplementary tests to be made, as, for instance, the testing of two walls built of bricks from the same lot and with mortar from the same batch, but without the soaking of bricks in one case.

Technical Phraseology to Be Standardized

Heating nomenclature was the subject of a report presented by W. H. Carrier, who was acting as a member of the committee on heat research of the National Research Council. Other bodies represented on the committee are the refrigerating, mechanical and electrical engineers. The system of nomenclature outlined in the report was adopted by the society and will be published as soon as the other participating organizations have taken action.

At the suggestion of Mr. Lewis, the chairman called on Mr. King, secretary of the National Association of Portland Cement Manufacturers, who invited the members to visit the association's laboratory and offices at Dearborn Street and Grand Avenue, Chicago. One of the interesting things that has been developed at the laboratory, said Mr. King, is that it is possible to make concrete with high insulating qualities, by making it less dense. Its heat-transmitting characteristics depend upon its porosity, and concrete can be made with enough air bubbles in it to increase its insulating properties greatly.

A paper, postponed from the morning session, was presented at this time, entitled "Architectural Aspects of Concealed Heaters," by J. Milliken and H. C. Murphy.

Architectural Aspects of Concealed Heaters

In this paper the authors present an argument for the proper installation of concealed heaters in order that the highest efficiency may be obtained and the appearance of the installation accord with the desires of the architect and owner, pointing out that the use of concealed heaters involves the application of conduction heat as opposed to radiant energy. Mr. Milliken briefly outlined the fundamental principles involved in surfaces. He presented many interesting photographs showing the successive stages of framing-in piping and placing the heater and showed a diagram indicating that these heaters, when properly placed, result in a much lower heat demand upon the boiler during the heating-up period. Commenting upon the necessity for careful installation, Mr. Milliken said:

"Stack effect is of the utmost importance in this new development. The intensity of its action depends upon the height of the stack and the difference in temperature between the heated air and the air entering the units. The efficiency of the units therefore depends considerably upon proper installation and consideration in the layout and design.

"In general, the length of the heater and the height of the stack are dependent upon the available wall space and the heating capacity required within reasonable limits, the higher the stacks the greater the capacity of the heater, provided the stacks are well insulated from heat losses."

Morning Session, January 30

If Tuesday afternoon's session could be called a research meeting, the session Wednesday morning properly could be termed an air conditioning symposium. Papers presented at this session included one by C. P. Yaglou and Philip Drinker W. E. Miller and W. P. Yant on "Heat and Moisture Loss from Human Body and Its Relation to Air Conditioning," one by C. P. Yaghou and Philip Drinker on "The Summer Comfort Zone: Climate and Clothing," and one by M. C. W. Tomlinson on "Low Humidity Psychrometric Charts."

The Summer Comfort Zone: Climate and Clothing

The paper read by Mr. Yaglou and prepared jointly with Philip Drinker was a determination of the summer comfort zone, coupled with a study of the relation of climate and season to the type of underclothing worn. The paper detailed a series of practical investigations largely carried on in the psychrometric chamber of the Harvard School of Public Health with 91 volunteer subjects. Procedure in the tests was approximately the same scheme as that used in previous parallel studies. From the resultant data it was determined that the probable cold limit of effective temperatures for summer conditions was 64° F. and the probable optimum 70.5° F. and the probable warm limit 79° F. Commenting on the desirability of determining the summer comfort zones, Mr. Yaglou said:

"In order to make crowded places comfortable during warm summer weather, American ventilating engineers have adopted the practice of maintaining indoors, by means of refrigeration, a dry-bulb temperature 8° to 15° F. lower than that prevailing out of doors. Their chief purpose is not so much to reduce the temperature to the optimum degree as to maintain a reasonably comfortable temperature and, at the same time, avoid causing sensations of chill or of intense heat in entering and leaving the building.

"This practice is justified in many crowded public buildings where the patrons spend a comparatively short period of time. According to our experiments, however, it is not adequate for indoor exposures of one and one-half hours or more—for offices, residences and the like. There seems to be no significant relationship between the two, since the optimum temperature in July, August and September remained practically the same, in spite of the fact that the outdoor temperature actually varied from 99.5° to 70° F. When the outdoor temperature was below 70° F. when 66° F. was registered—the optimum temperature did drop slightly, as shown in the table, but too much stress must not be laid upon this circumstance because of the limited number of observations, all made in the course of a single experiment. Nevertheless, it is clear that 70° F. or slightly less, is the lowest summer or winter temperature to which people in the United States are adapted in their living and working quarters. It may be taken as the temperature above and below which significant changes in adaptation and clothing are to be expected."

A correlated study involved the determination of underclothing commonly worn during the summer period, and this was ascertained by questionnaires to clothing stores throughout the country. After making an analysis of the data thus secured, Mr. Yaglou said:

"The summer comfort zone for men and women in the Untied States wearing customary warm weather clothing has been found to lie between 64° and 79° F. on the effective temperature scale. The probable optimum is 70.5° F. effective temperature. On the average, these values are about 4.5° effective temperature higher than those found in winter, when customary winter clothing was worn. The difference is ascribed to adaptation to seasonal weather as well as to seasonal variation in the clothing worn.

A definite relationship is shown to exist between the seasonal outdoor temperature and the kind of underclothing worn. Pure woolen underwear is popular only in those localities of the United States in which the average winter temperature falls below 20° F.; wool and cotton mixtures are preferred in cities having winter temperatures between 20° and 37° F.; in warmer cities, where the temperature ranges from 38° to 50° F., medium weight cotton is worn by the majority; when the average temperature exceeds 50° F., whether in summer or in winter, the greater part of the underclothing worn is light weight cotton.

Low Humidity Psychrometric Charts

In this paper the author details the necessity for and the preparation of psychrometric charts possessed of a high degree of accuracy and readable to 0.1% relative humidity over a dry-bulb range of 20° to 120° F. and a relative humidity range from zero to 15%. The desirability of these charts has arisen through new developments in the electrical industry by which better electrical characteristics are procured through air conditioning at very low humidity, and the possibility of using such low humidities in any locality to cure diseases now treated by sending patients to dry climates.

Dehumidification at low relative humidities, in the neighborhood of 10%, have been used in the electrical industry for over three years, and it is predicted that within a year humidities of the order of 1% will be possible to produce

and maintain. It has been shown that workmen subjected to low relative humidities are quite free from colds, and indications are that medical specialists will utilize artifically produced low humidities for the treatment of certain types of diseases, especially pulmonary, so that patients can have the benefit of ideal atmospheric conditions without leaving their places of residence or business.

Mr. Tomlinson outlined the advantages of a semi-logarithmic chart such as that developed by Claude A. Bulkeley and then proceeded to the development of his own two charts, which were presented with the paper.

In the discussion Professor Larson cited the conditions he had noted during a dance at the University of Wisconsin in which the relative humidity of the hall rose from 18% to 32% due to the crowded conditions of the hall. Even by supplying air at 39° F. it was impossible to bring the temperature of the room down below 70°. "We have few data," he said, "on the amount of heat dissipated by crowds." In his own practice he uses 550 B.T.U. per hour per person.

President Willard interrupted the program at this point to introduce J. I. Lyle, a former president of the society, and Thornton Lewis, the president-elect. In responding Mr. Lyle stated that 22 of the past presidents are living and that 17 of them are still in active business.

What was characterized by many as one of the most important papers of the meeting was presented by S. C. Bloom on the subject of "Cooling and Humidifying of Buildings."

Cooling and Humidifying of Buildings

Calling attention to the fact that heating plants are used in buildings of every character during the winter season, Mr. Bloom predicted that the time is close at hand when provision for comfort in hot weather also will be classed among the necessities. The greatest field, in his opinion, lies in the cooling of office buildings because of the direct, although intangible results which accrue from the maintenance of conditions under which people can work to the best advantage. "The cooling of an office building presents some interesting considerations," said Mr. Bloom. "There is a high percentage of window area, wide variation in intensity and distribution of solar radiation and windage, flue effect and the necessity for conserving usable or rentable area."

Mr. Bloom then outlined the relative importance of the various factors involved and outlined the mechanical processes required. He emphasized the fact that in the cooling of buildings during the summer season no attempts should be made to cool down to the normal indoor temperature required during the winter months.

"A condition of 85° F. and 40% relative humidity," he said, "would be unbearable in a room during the heating season, and yet be gratefully comforting when it is 95° F. and 50% relative humidity outside. The provision of a reasonable contrast between indoor and outdoor conditions should be the objective. Excessive cooling in summer is just as objectionable as overheating in winter.

"It then would seem reasonable that the maintenance of an effective temperature indoors midway between that prevailing outdoors and 66° F. would afford the maximum comfort contrast with the minimum disturbance in the body temperature control mechanism of those passing indoors and outdoors. The human body can adapt itself to variations in the condition of its atmospheric environment throughout a reasonably wide range without difficulty. It would seem logical, then, in the artificial cooling of buildings to minimize the variations to which the occupants are subjected in passing into or from a building, bearing in mind that the change in conditions is abrupt and hence their influence is temporarily magnified."

President Willard praised the paper as one of vision and said that he believed the prophetic statements made by Mr. Bloom might be realized sooner than anyone anticipated. Mr. Hallett announced that many of the ideas suggested by Mr. Bloom would be incorporated in the new office building to be built for the St. Louis Board of Education. The building not only will be cooled but will be heated throughout by a fan-blast system.

"At least ten days of every year," said Mr. Hallett, "are lost by the school children of St. Louis due to the excessive heat, it being the rule to adjourn school when the outside temperature reaches 90° F. We have come to the point when no one dies from the effects of cold but many deaths are reported every year from over-heating."

M. C. W. Tomlinson declared that revolutionary events are transpiring in the air-conditioning field and he cited an installation in which the relative humidity of the air had been cut down to 0.5%. He predicted that hospitals and sanitariums soon would be using installations to provide this low humidity and cited a case of a New York hospital which is experimenting with such air conditions for the cure of pneumonia. He felt that the object of the air-conditioning industry should be to promote increased employment rather than to decrease the number of operatives.

Dr. E. V. Hill referred to the advances which have been made in the ionization of air and said that he felt that ozone yet might fill the place predicted by its early advocates.

At the conclusion of the session President Willard announced the serious illness of John Gormly, of Philadelphia, an honorary member of the society. Two new honorary members then were elected, O. P. Hood, chief mechanical engineer of the Bureau of Mines, whose name was placed before the society by Samuel R. Lewis, and Stewart A. Jellett, the first regularly-elected president of the society to serve a full term. Mr. Jellett's name was offered by Thornton Lewis.

Afternoon Session, January 30

Wednesday afternoon marked the high spot of the meeting when the proposed revised boiler testing code and the proposed boiler rating code were offered for adoption. Many prominent boiler manufacturers were among those present although Dr. Charles W. Brabbée was the only speaker directly representing the manufacturing interests.

Alfred Kellogg, chairman of the society's committee on rating low-pressure heating boilers, presented both codes. He said that each code had received the unanimous endorsement of the council.

It also was announced by Professor Willard that in case the codes were adopted, it was the society's purpose to appoint a continuing committee to be composed of the new chairman of the research committee, L. A. Harding; the director of the research laboratory, F. C. Houghten, and R. V. Frost, to interpret the codes, and to suggest any changes that might be found desirable.

Mr. Kellogg reviewed briefly the history of the proposed code and said it was the desire of the committee to devise the simplest possible rating factors. The motion to adopt the testing code was made by Dean Anderson and his motion carried without discussion.

Mr. Houghten then explained the working of the proposed rating code with its three determining factors of fuel rate, flue-gas temperature and draft. He took some typical boiler test curves and applied them to the chart which formed a part of the code. First a point was found where the fuel rate intersected an arbitrary curve on the chart. Another point was taken where the flue-gas temperature intersected a similar arbitrary curve on the chart. A rating was then determined at a point one-third of the way between the fuel-rate intersection and the flue-gas temperature intersection.

Dean Anderson was among those who

favored the adoption of the code as was W. H. Carrier, in spite of the fact that both had opposed the code's adoption at the West Baden meeting last summer. Dean Anderson pointed out that two of the main objections he had to the code as previously proposed had been eliminated, namely, the 700° limiting flue-gas temperature and the provisions for boiler selection.

Dr. Charles W. Brabbée argued that the proposed code had not been discussed with the boiler manufacturers and, therefore, he moved that action be deferred until a conference could be had with the National Boiler and Radiator Manufacturers Association. Others who spoke on the subject were F. D. Mensing and President-elect Thornton Lewis, both of whom urged immediate adoption, and R. V. Frost, who told of the efforts of other organizations to solve the boiler rating problem, notably the Heating and Piping Contractors National Association, the Chicago Heating and Piping Contractors Association and individual manufacturers, such as the American Radiator Company and the Richmond Radiator Company. He then called attention to the new boiler testing code developed by the National Boiler and Radiator Manufacturers' Association, which had been adopted unanimously by that body.

Before the vote was taken, H. M. Hart arose to state that the performance charts originally put out by the H. & P.C.N.A. never had been abandoned by that association but that only two manufacturers had made full use of them.

Without further discussion, and in response to many cries for the "question" President Willard called for a standing vote. The response was almost unanimous in favor of the code's adoption.

Rating Code for Boilers Burning Solid Fuel

WHEN requested by the committee on rating low-pressure heating boilers to reconsider its status after the June, 1928, report was referred back to the committee, the council stated that "The boiler rating code requested should embody the best judgment of the committee, in the light of West Baden and other discussions, of what will constitute the most workable code." The latest report of the committee was approved by the council at its meeting Dec. 6. The new code, complying with the instructions from the council, and adopted Jan. 30, is here printed in full.

Rating outputs, it was recommended in previous reports of the committee, should be based on the flue gas temperature and safety from priming. The numerical value of the flue gas temperature is immaterial, but the meaning which will be associated with rating values so determined will depend on these numerical values. Previous reports of the committee have pointed out that the information conveyed by such a rating output is only a part of the data required in comparing boilers, and that the other operating characteristics, such as stack draft and rate of combustion also must be given consideration. These reports also have shown that if a standard method of rating were adopted, then the code for selection could fix the relationship between the maximum demand load and the rating output and could vary the ratio between these with the boiler size, or could change it from time to time to meet service conditions.

Speakers at the semi-annual meeting of the Society were in favor, without knowing how it was to be done, of an arbitrary method of rating by which the numerical value would express a combined measure of the grate area and the heating surface. The value of these two factors is expressed in terms of operating characteristics by the rate of burning and the flue gas temperature, respectively. This principle is embodied in the code as adopted. An arbitrary output equality is established between boilers of different ratios of heating surface and grate area by balancing one against the other; further, the priming limitation is retained.

As adopted, the code assumes that a series of tests have been made and that a performance chart is plotted; for this purpose a complete chart is not necessary and the tests could be restricted to the range of outputs in which that of the rating value probably will occur. The arrangement of the code also is such that water boilers can be included in the future when it is desired to determine the rating output of water boilers which are tested as such.

The code is brief. Tabulations for measurements of the boiler have been omitted; fuel analysis and heat balance have been taken care of in such a way that the tabulated items have been reduced to the smallest number consistent with the various uses to which the code may be put.

After the buzz of conversation had subsided the business of the meeting proceeded with the presentation of a paper by L. W. Leonhard and J. A. Grant on "Frost and Condensation on Windows."

Frost and Condensation on Windows

This paper primarily involves a determination of conditions under which frost and condensation form on window glass and represents one of the interesting features of research carried out by a manufacturer in order to better his product. According to the writer, there are several reasons why the frost and condensation problem has grown more acute. He said:

"The advantages of higher humidity of the air have resulted in the development and use of means for maintaining a higher moisture content than formerly. Better construction, at the window openings, has materially reduced the rate of exchange of air between the inside and outside of buildings, thus causing a building up of the moisture content of the inside air. Buildings nowadays have a much greater window area, and the amount of condensation is dependent upon the amount of window surface.

"All of these factors have contributed to render the condition more favorable for the deposition of moisture upon cold window surfaces. Not only has the amount or quantity of water thus deposited on the coldest days of the heating season been increased, but the formation of moisture occurs on more days of the season, because the favorable conditions enumerated above result in condensation at a higher outside temperature."

The set-up for this experimental work consisted of a small window two panes wide and three high placed in one end of a cold box in the laboratory's refrigerating plant in the University of Michigan. Any desired low temperature could be maintained on the one side of the window with an ordinary room temperature on the other. Small thermocouples, flattened out very thin, were glued to the glass or other surface to be examined, whereby the temperature of those surfaces could be ascertained. A variable speed fan was located in the box, so that when desired, the cold air could be blown over the surfaces of the window, thus simulating wind conditions. The humidity of the air on the warm side could be varied by releasing steam into the room.

The objective of the tests was to determine the ratio of the difference between the temperatures of the inside surface of the glass, or other surface examined and that of the cold air, to the difference between the temperatures of the warm and cold air.

Summarizing the results, the writer said:

"The thickness of the glass, within ordinary values, has but little effect upon the temperature of the inside surface. Both ¼-in. and ⅛-in. glass were tried. The thinner glass showed a slightly lower temperature, but not enough lower to warrant discrimination

in the value. The resistance to heat transmission of the glass itself is so low, compared with that of the air films, that differences in thickness of ordinarily used glass introduce but a slight effect.

"Circulation of air on the warm side of the window by a fan tends to nullify the effect of the wind on the cold side, and brings up the inside temperature of the glass to approximately the mean of the cold and warm air temperatures, which is the condition for no wind or forced circulation on either side.

"Insulating the glass pane from the metal member of a steel window by a felt strip or by using a framing member of wood has no effect upon the formation of condensation or frost.

"Double glazing, consisting of two ⅛-in. panes in contact, brought the factor *f* up from 0.25 to 0.35 with wind. The surfaces, although in contact, appear to offer a considerable hindrance to heat transmission."

The session concluded with a report of the *Guide* Publication Committee.

Morning Session, January 31

Two papers were presented at the morning session on Thursday, one being devoted to the "Application of Oil Burners to Various Types of Domestic Heating Systems" by J. H. McIlvaine, and the other to "Laundry, Kitchen and Hospital Equipment" by H. C. Russell, which appears on Page 88.

Afternoon Session, January 31

The final paper on the program was presented by G. E. McElroy on "Ratio of Opening of Fan Performance in Terms of Direct Pressure-Quantity Relations."

At this point President Willard yielded the gavel to the new president, Thornton Lewis. Following the presentation of a number of resolutions, the meeting adjourned.

This paper is a highly technical treatise describing the author's method of presenting data on fan performance characteristics. The author states that he has been particularly interested in mine fans for which the available performance data are in the form of ratio charts in which performance ratios are plotted against ratio of opening. Ratio of opening is the ratio that the area of an orifice on the discharge end of a short test duct bears to the area of the duct which is made the same as that of the fan discharge. In attempting to correlate ratio of opening used as a basis for expressing relative fan performance, the author has analyzed the results of pressure-loss experiments on orifices, and has found that, within practical limits of application, a single constant can be used to define a type of orifice. The use of this constant is proposed as a method of fairing-up experimentally determined coefficients of discharge for orifices.

The constant derived from experiments has been used in calculating values of ratio of opening, and velocity-pressure ratios, in terms of direct pressure-quantity relations. This involves a new conception—termed "resistance constant"—for the expression of pressure-quantity-area relations. A chart, based on this new conception, is presented for the rapid graphical determination of ratio of orifice, and velocity-pressure ratios from direct pressure-quantity relations.

Effect of Pressure on Fuel Consumption

A question which has provoked considerable discussion in the columns of THE HEATING AND VENTILATING MAGAZINE'S B. T. U. Club had to do with the effect of steam pressure on fuel consumption in heating systems. As propounded, the question was: The owner of a steam-heating system operating at 2.3 lbs. pressure with returns coming back at a temperature of 212°, contemplated changing it so as to operate at 15.3 lbs. pressure with a return-water temperature of 242.9°, the radiation being varied in amount to maintain 70° in the rooms. Which system will require the more fuel to operate?

One correspondent (Answer 2) maintained that the boiler operating at 15.3 lbs. gauge pressure would require more fuel due to the fact that the difference in temperature between the water in the boiler and the gases of combustion would be less than at 2.3 lbs. pressure.

Combating the point another correspondent quotes the U. S. Bureau of Standards to the effect that the rate of heat transfer in a boiler is not directly proportional to the temperature differential as the quantity of heat a boiler will absorb per unit of time depends almost entirely upon the quantity of available heat delivered to it, rather than the temperature of this heat.

On the point that radiation losses would be reduced with lower steam pressures, the difference, he states, would not be important, as smaller pipes could be used at the higher pressure. He figures it out this way:

Assume 967.4 B.T.U. (the latent heat per pound of steam at 2.3 lbs. pressure) as the hourly heat loss from the building, then $(967.4 \div 947.1) = 1.02$ lbs. will be required at 15.3 lbs. pressure, 947.1 B.T.U. being the latent heat at the latter pressure. Now the volume of steam required at the higher pressure will decrease by about 41%, thus $(1.02 \times 13.76) \div 23.82 = 59\%$. The preceding figures are the respective volumes in cubic feet per pound of steam.

The temperature difference and thermal losses at the higher pressure for 60° basement air will increase by $(190.3 \div 159) = 20\%$, but the reduction of pipe surface for the decreased volume will probably be in the neighborhood of 30%, so if we assume the radiation losses in equivalent direct radiation from the boiler and piping as 25%, which it usually is, and allow 3% of this amount for the boiler loss it will be found that the approximate overall saving in thermal losses from the heating system using the higher pressure will only be 3%, thus

$$[(22\% \times 70\%) + 3\%] \times 120\% = 22\%$$

The above figures might be changed somewhat because the commercial sizes in which pipe may be obtained would limit the reduction of pipe sizes to some extent.

It is also interesting to observe that at the higher pressure the weight of steam required increases slightly, the volume of steam decreases materially while the total heat of the steam per pound increases by $(1165.7 - 1154.4) = 11.3$ B.T.U. The temperature of the return water also increases.

In connection with the above facts the following analysis will show just what loss might occur due to carrying around of this additional heat from the boiler to the radiators and back again without doing any work. For example, the weight in pounds of condensation returned to the boiler in per cent of that delivered by the boiler, taking 187 at 2.3 lbs. and 218.3 at 15.3 lbs. as the heat units in the condensation are 16.2 and 18.7%, respectively, computed thus,

$$187 \div 1154.4 \text{ total heat} = 16.2\% \text{ and}$$
$$218.3 \div 1165.7 = 18.7\%.$$

This, however, does not mean that there is such a difference in economy because we know that in operation steam enters the radiators and gives up its latent heat and that it is only this heat which does the work of warming. This being so, the condensation, which is at the same temperature as the steam, returns to the boiler with all of the original heat in the steam which is not used for warming. However, the heat returning to the boiler is again circu-

lated to the radiators without loss, and the only loss, if any, is the heat or weight carried around the cycle without doing any work.

In the consideration of savings due to steam at various pressures there are certain points that should not be overlooked, for example, the saving due to the greater operating range of pressures by the use of higher pressures. Such savings are made with vapor and hot water systems due to the fact that the temperature of the radiators may be moderated with the changes of weather.

A system designed for the maximum load at 15.3 lbs. pressure would doubtless never have to be operated at less than atmospheric pressure. This would eliminaté the re-entry of air into the system and with it the time element in raising pressure, during which time a stack loss takes place, yet without heating being done. The higher pressure also would quickly vent the air if this were required.

Against this saving and the greater efficiency of air-freed radiators we have the increase in maintenance losses at the higher pressure due to troubles with air valves or traps, the packing of control valves, wire drawing of valve seats, carbonization of dust on radiating surfaces, discomfort to those sitting close to the radiators and the greater heat loss to the outside of radiators on outside walls.

ANSWER 5

In Answer 5 it was assumed that the volume in the low-pressure system of 1000 cu. ft. to be filled with steam. Then 1000 divided by 22.98 (the volume occupied by 1 lb. of steam at 2.3 lbs. pressure) equals 43.5 lbs. of water to be evaporated at 2.3 lbs. To find the comparative size of each system:

High pressure 250° — 70° = 180°
Low pressure 219° — 70° = 149°

Since the emission of a square foot of radiation is at the rate of 1.65 B.T.U. per sq. ft. per hr. per deg. difference in temperature, we have:

High pressure $180 \times 1.65 = 297$ B.T.U.
Low pressure $149 \times 1.65 = 245$ B.T.U.

Therefore, the high-pressure system must have $\frac{245}{297}$ or 83% of the volume of the low-pressure system. 83% of 1000 cu. ft. equals 830 cu. ft. 830 divided by 13.48 (the volume of 1 lb. of steam at 15.3 lbs. pressure) equals 61.5 lbs. of water to be evaporated at 15.3 lbs. pressure. Since the latent heat of steam at 2.3 lbs. is 936.9 B.T.U., and at 15.3 lbs. is 915.9 B.T.U., we have:

Low pressure 43.5 lbs. × 936.9 B.T.U. per lb. = 40,755 B.T.U.

High pressure 61.5 lbs. × 915.9 B.T.U. per lb. = 56,290 B.T.U.

56,290 — 40,755 equals 15,535 B.T.U. more required to operate the system under high pressure.

$\frac{15,535}{40,755}$ = 38% more heat required to operate the high-pressure system than the low-pressure plant.

"Answer 5" declares our correspondent, is a curious paradox in that the high-pressure system apparently transmits much more heat to the building, the figures showing a total disregard of the assumption made in the original question that the radiation would be varied in amount so as to maintain 70° in the building. Obviously, the transmission of heat from the radiators must equal the building losses, which losses were assumed as a constant irrespective of the steam pressure used.

"On the face of it the answer is wrong, thus inviting further examination. This soon discloses the fact that the time element has been entirely ignored. It may be assumed, as stated in the answer, that a given heating system containing 1000 cu. ft. of steam will have the required amount of radiating surface, at the lower steam pressure, to condense 1000 cu. ft. of steam hourly and warm the building to 70°, and that another system to produce the same heat effect will have only 83% of the above surface, due to the greater transmission of heat at the higher pressure and, therefore, contain only 830 cu. ft. of steam. This, however, does not follow that the last system will require and condense 830 cu. ft. of steam in an hour simply because it contains that volume or has 83% of surface of the other system.

"As a matter of fact, it will take 1 hr. 23 min. to condense the 830 cu. ft. of steam, or, in other words, only 600 cu. ft. of steam will be condensed in an hour if we accept the correspondent's base figures as being correct (which incidentally they are not). Thus the total heat transmission from radiating surfaces, which should be the same in each system, divided by the latent heat at the higher pressure and the quotient multiplied by the specific volume at that pressure equals 600 cu. ft., or (40755 ÷ 915.9) × 13.48 = 600.

"Again the answer can be proven in error by another simple method, thus 40755 ÷ 245 (B.T.U. per square foot of surface at the low pressure) = 166 sq. ft. and 56,290 (heat transmission at the higher pressure as computed in the answer) ÷ 297 = 189 sq. ft., which is a 14% increase in radiating surface instead of being 83% of the low-pressure surface.

LATENT HEAT OF STEAM

"Aside from this the correspondent errs in the figures used for the latent heat of steam. Apparently these figures have been derived by subtracting the temperature of the steam, instead of the heat of the liquid, from the total heat of the steam. Furthermore, the transmission of a square foot of radiation per degree of temperature difference at the standard temperature difference of 150° is 240 ÷ 150 = 1.6, instead of 1.65, and this figure varies by 2% for each 10° variation from the standard temperature difference, thus the coefficient at 15.3 lbs. pressure (250° temperature, 180° temperature difference) would be 1.6 + (3 × 2%) = 1.7, which times 180 = 303 B.T.U., instead of 297 B.T.U. The figure of 2% is near enough for all practical purposes and can readily be verified by consulting the well-known tables on radiator transmission as published in the A.S.H. & V.E. *Guide*, for 1928."

New Technical Secretary for the A.S.H.&V.E.

Paul D. Close, of Chicago, has been appointed technical secretary for the society for the year 1929. This is a newly-created position. Mr. Close took up his duties at the society's headquarters

P. D. Close

January 14. His work will include the compilation and editing of the text section of the A.S.H. & V.E. *Guide*, the reviewing of technical articles and meet-

ing papers, coordination of data for preparation of society codes and standards and work with technical committees of the society on development of practical applications of research and experimental data.

Mr. Close was born in Chicago on October 17, 1897, and was graduated from the Crane Technical High School in Chicago and the University of Illinois, having received the degree of bachelor of science in mechanical engineering at the latter institution.

After leaving the University of Illinois in 1921, Mr. Close joined the Johns-Manville Corporation where he specialized in refrigeration and architectural acoustics. He then took a position with The Celotex Co., of Chicago, where he later was appointed assistant manager of the building department, specializing in problems of insulation.

Mr. Close joined the society in 1928, and received his first recognition from the *Guide* Publication Committee when he prepared the heat transmission tables and a portion of the manuscript for Chapter 1 of the *Guide* for 1928. He also assisted in preparing the revised data for Chapter 1 of the 1929 edition. He is the author of a book entitled "Heat Insulation," and has prepared a number of pamphlets dealing with problems of insulation such as heat transmission, fuel saving, radiation saving, and the prevention of roof condensation.

Society's Journal to be Published as Section of Trade Magazine

Effective May 1, 1929, the *Journal* of the A.S. H.& V.E., it is announced, will appear as a section of a new magazine to be called *Heating Piping and Air Conditioning*, with publication offices in Chicago. It is stated that all meeting papers, laboratory reports and other announcements will appear in that periodical after May 1, thereby making it the official organ of the society. Each member of the society will receive a copy of this new publication and a portion of his dues will be allotted to the payment of his subscription. No explanation was made as to what advantages members would have over non-members in this respect.

The opinion is expressed in the announcement that the financial arrangement made for the period of this contract will be adequate compensation for the discontinuance of the *Journal* as a separate publication.

Michigan Chapter Meeting

Members of the Michigan Chapter and friends to the number of 52 gathered at the General Motors Building, January 14, to participate in an interesting program. The principal speaker was Hiram L. Walton of Smith, Hinchman and Gryllis, who detailed a method by which the new Union Trust Building will be supplied with conditioned air. Mr. Walton presented specific information concerning comparative air conditioning projects, six of which are being handled in his office. This information was tabulated as follows:

COMPARATIVE AIR CONDITIONING DATA

	Bank & Off. Bldg.	Dept. Store	Dept. Store	Dept. Store	Bank & Off. Bldg.	Theatre	Restaurant
Cost in $ per sq. ft. of Floor Area	$1.50	$1.87	$1.75	$1.60	$ .95	$4.07	$2.88
Cost in $ per cu. ft. of Floor Vol.	.107	.166	.14	.147	.080	.20	.26
Cost in $ per c.f.m. of Air Cond. System	.92	1.20	1.03	1.23	1.05	.81	1.17
Cost in $ per ton of Refrigeration	$384.00	$345.00	$444.00	$475.00	$368.00	$398.00	$365.00

Nelson B. Hubbard followed Mr. Walton with a discussion of unit heaters, during which he indulged in reminiscences of early days in this field. Mr. Hubbard stated that unit heaters have been sold by members of the chapter as far back as 25 years ago.

Mr. Walton brought out the fact that this is comparatively a pioneer installation of air conditioning in an office building, as there are but a few other office buildings in the United States which are so equipped.

The first sixteen floors of the Union Trust Building are furnished with conditioned air. No direct radiation whatever is used on these floors. Six ducts supply air to each floor and each exposure of building on each floor is fed from a separate riser. In each of the six ducts on each floor, there is a Booster Heater and this Booster Heater is thermostatically controlled from the region which it serves and the temperature in the building is automatically controlled by this method in winter. The cooling effect during the summer months is also under control.

The conditioned air is delivered in each room near the ceiling and exhausted near the floor to the lobby of the T suite of offices and thence to the corridor of the building. The exhaust system handles approximately 25% of the air supplied as part of the air is recirculated.

St. Louis Chapter Elects Officers

Officers elected at the annual meeting of the St. Louis Chapter, which was held at the Roosevelt Hotel, December 5, are: President, F. J. McMorran; first vice-president, E. A. White; second vice-president, C. G. Buder; treasurer, E. H. Quentin, and secretary, R. M. Rosebrough. Board of governors: L. Walter Moon, A. E. Humphreys, J. Lawrence DeNeille and Ralph E. Graves.

A committee of three was appointed to legislate the proper ventilation of buildings in the City of St. Louis. The members appointed were Walter Keiser, chairman, William Sodemann, and J. M. Foster.

Illinois Chapter

"Ionization and Its Relation to Ventilation," was the subject of a talk delivered by Frank E. Hartman, chief chemist, U. S. Ozone Company, at the January meeting of the Illinois Chapter, held at the Hotel Sherman, Chicago, January 14. Mr. Hartman illustrated his lecture with slides. Seventy members were present.

Applications for membership were received from H. L. Stiles, of Edison Electric Appliance Company and H. H. Valiquet, who were admitted to the chapter.

Professor Willard at Minnesota Chapter

Professor Willard was the principal speaker at the January meeting of the Minnesota Chapter, held in the Men's Union Building, University of Minnesota, January 15. His subject was "Research in Heating and Ventilation at the University of Illinois."

The Sulphur Problem in Burning Coal

Clinkering of the ash in a furnace does not always vary directly with the sulphur content of the coal, according to technical paper No. 436, recently issued by the United States Bureau of Mines. In common practice, the sulphur content has been used as an index of clinkering tendencies, and for many coals it will serve fairly well for this purpose. The fusibility of coal ash depends upon such factors as the ratio of the silica to the bases, the nature of the bases, the percentage of aluminum, etc. When the ratio of the silica to the bases is very high or very low the ash-fusion temperature is high.

Selecting and Operating Laundry, Kitchen and Hospital Equipment

Part I—Laundry Equipment

By H. C. Russell

From a paper presented at the annual meeting of the American Society of Heating and Ventilating Engineers, in Chicago, January 28-31, 1929.

IT is not proposed to discuss custom laundries here, but rather, the flat-work laundries which are found in hotels and institutions. Custom laundries are seldom designed to meet certain, definite requirements as in a hospital having so many beds or a hotel of a large number of rooms; they are often built to represent an investment, to meet special requirements in a general way, such as serving one type of population. In hotels and institutions, flat-work laundries are found which have more definite requirements, both as to volume of work and character. Most of the linen in such institutions consists of flat work, such as sheets, towels, pillow-cases, blankets and table linen.

A great variety of special machines, used mostly in custom or general laundries will not be mentioned here. Some of these are used occasionally in flat-work laundries where a limited amount of other classes of work is to be done, but usually they occupy little floor space and use small amounts of steam, water and electricity. When needed, they may be added without materially affecting the layout of the other and larger machines requiring more floor space, steam, water and electricity. This class includes washing machines, extractors, tumbler dryers and flat-work ironers.

Some notable changes have taken place in the laundry industry during the last decade. The engine and line shaft which were used for many years have been replaced by individual motor-driven machines; the former reversing mechanism of washers has been substituted by reversal of rotation of the motors driving them. In such a laundry, the electrical mechanism for reversing motors, the switches and rheostats is mounted on a central control panel; the remote control devices are operated by a push switch at the machine.

The reversal mechanism of washers and tumbler dryers is so arranged that two or more machines controlled from the same board cannot be reversed simultaneously in order to flatten out the load curve on the feeders. This is important, especially when alternating current is used, for such motors take nearly twice their running current while starting. Ordinarily, each washer is reversed every eight seconds.

With remote control, a great deal of tampering of the switching mechanism has been eliminated. The amount of exposed gearing and energized electric wiring has also been reduced to a minimum, thus doing away with a great many accidents.

THE requirements of laundry, kitchen and hospital equipment vary widely, *first*, because there are so many different classes of laundries, kitchens and hospitals, and *second*, because the operating technique is rarely the same. Equipment for any of the above mentioned which has been perfectly satisfactory may suddenly become absolutely inefficient when a new laundryman, a new cook or a new set of nurses has been employed.

The data and methods given herein are for average operating conditions, but special consideration should be given unusual requirements.

Piping systems for laundry, kitchen and hospital equipment should have separate flow and return lines, the former of which may be either above or below the equipment; the return lines, however, should be located below.

Traps (preferably thermostatic) are placed on each coil or unit, and the condensation is led into a return main which is itself vented, and proceeds by gravity into a vented receiving tank.

The vertical pipe in connections, especially the drop lines from overhead steam mains, should be dripped through separate traps although they may be omitted, as the fixture coils and traps will care for a limited amount of condensation when the fixture valves are opened up without any damage ensuing.

The steam mains should be dripped and drained in about the same manner that would be required in steam piping for any other purpose.

Proportioning Equipment

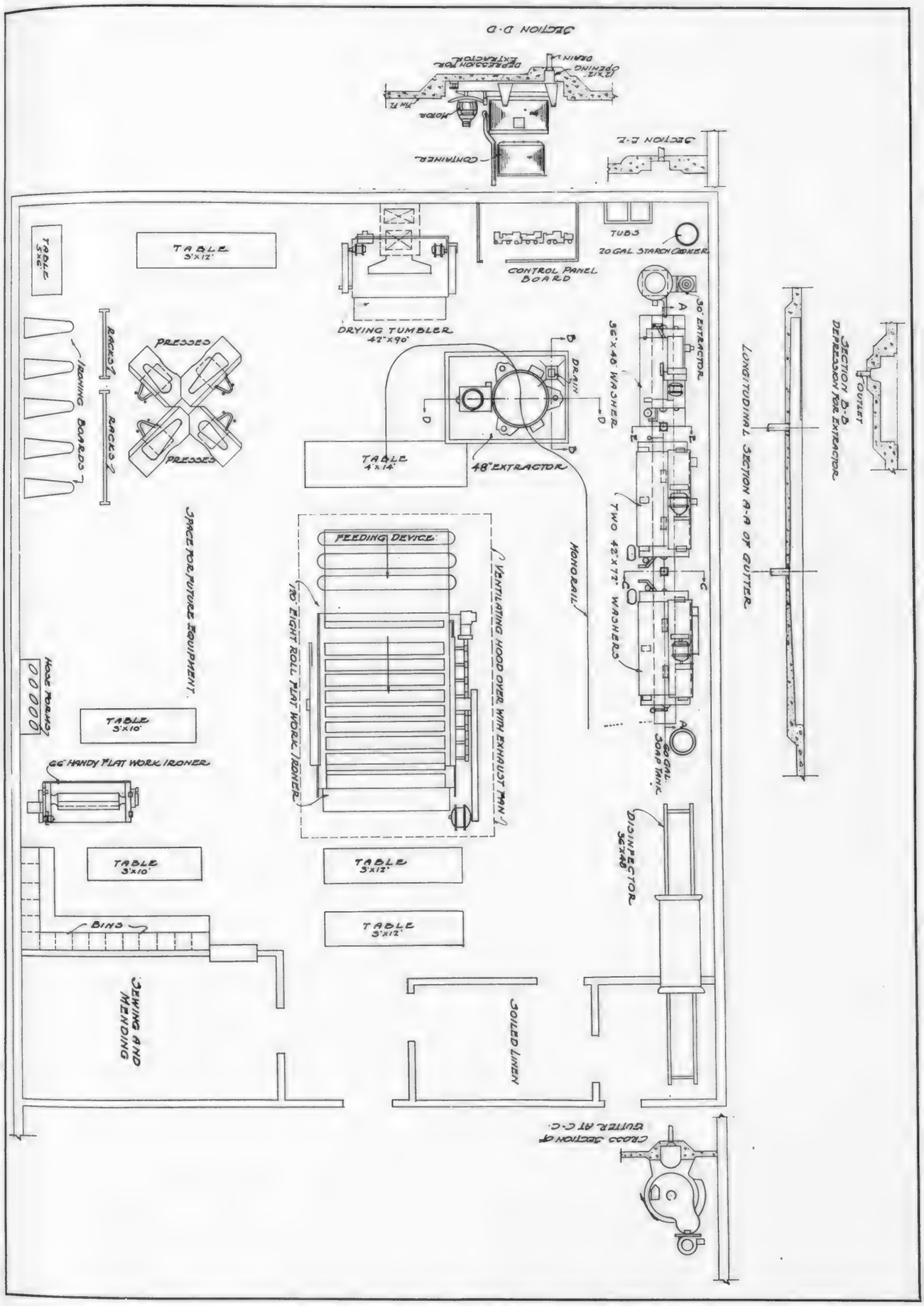
Probably the minimum equipment of a well-furnished flat-work laundry, the capacity of which is beyond the domestic plant, is comprised of the following: One 36-in. by 48-in. washer, one 36-in. by 64-in. washer, one 26-in. centrifugal extractor, one four-roll 90-in. flat-work ironer, one 30-in. by 42-in. drying tumbler, one two-truck dry room, one 15-gal. starch cooker, one 38-in. pressing machine, one hand ironing board, two 8-lb. electric irons, two laundry tubs and one wringer.

In a hospital laundry one 36-in. by 42-in. by 84-in. disinfector is usually installed, which is large enough to receive an ordinary hospital mattress without distorting it. The disinfector is placed in the laundry in order that the clothes may be sterilized before being washed.

Such a laundry would meet the requirements of a 250-bed hospital or a 350-room hotel on a basis of 44 hrs. per week, although for a smaller number the equipment would be about the same but operated fewer hours per week. In the minimum laundry, the prime purpose of the two washers is to provide for break-down service. Washers require repairs oftener than any other machine in the laundry, also, and are indispensable to the operation of the plant. It has been found desirable to have one small washer installed, regardless of how many larger ones are in operation.

A few typical cases which have proved ample but not extravagant are cited.

The demands of a 750-bed tuberculosis hospital were met by the following equipment, on a basis of 44-hrs. operation per week:



Layout of a Laundry for a 500-Bed Tubercular Hospital

Selecting and Operating Laundry, Kitchen and Hospital Equipment

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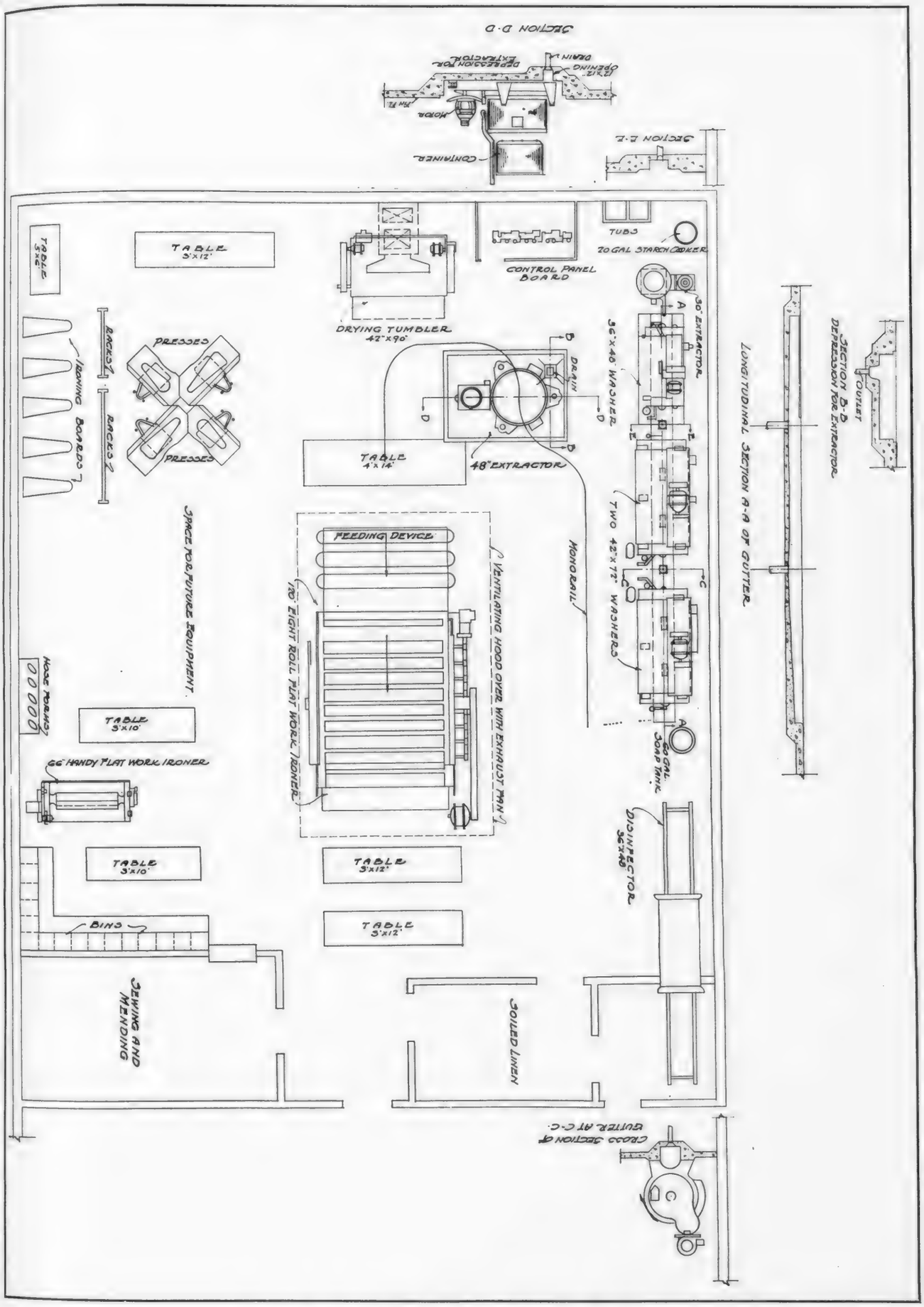
A few typical cases which have proved ample but not extravagant are cited.

The demands of a 750-bed tuberculosis hospital were met by the following equipment, on a basis of 44-hrs. operation per week:



Layout of a Laundry for a 500-Bed Tubercular Hospital

One 36-in. by 48-in. washer.
One 36-in. by 64-in. washer.
One 30-in. and one 26-in. extractor.
One 42-in. by 72-in. drying tumbler.
One 120-in. five-roll flat-work ironer.
One 36-in. high 42-in. wide and 84-in. long disinfector.
One two-truck dry room.
Four hand ironing boards.
Six 8-lb. electric irons.
Four hand laundry trays.
Four wringers, mounted on laundry trays.
Two 15-gal. starch cookers.
Two 60-in. long starch tables.
Three 38-in. pressing machines for uniforms, etc.
One 60-gal. soap tank.

The flat work for a system of dormitories in which 1800 women were housed and fed was done in a laundry with the following equipment, on a 44-hr. per week basis:

Seven 36-in. by 64-in. washers.
Five 26-in. and 30-in. extractors.
One five-roll 110-in. flat-work ironer.
Two 42-in. by 72-in. tumbler dryers.
One six-truck dry room.
Four 15-gal. starch cookers.
Four 60-in. long starch tables.
Two hand ironing boards.
Three 8-lb. electric irons.
Two hand laundry trays.
Two wringers, mounted on laundry trays.
Three 38-in. pressing machines for uniforms, etc.
Three 49-in. pressing machines for uniforms, etc.
Four 60-gal. soap tanks.

Washing Machines

The washers used in these instances were of the standard type, and about one cycle or washing per hour was accomplished.

A "high-duty" washer, as it is called, makes it possible to approximate two cycles per hour, and differs from the standard type in that it has nearly twice as many supplies and waste connections and thus fills and discharges more quickly. In order to realize the advantages claimed for these machines, however, it is necessary that the machines be charged and discharged with corresponding rapidity.

The "sterilizing," another type, has a steam tight body, operating with a pressure of about 30 lbs. steam while washing. Although more expensive in initial cost and upkeep than other types, this washer is sometimes used in hospital laundries.

Cylinders of washers may be one or two compartment by providing a partition in the center. Where a number of machines are installed, only two, perhaps, need be two-compartment type. Having compartments facilitates keeping pieces separated according to size and classes. This kind of separation makes for more efficient handling at all stages of the process.

About 2 lbs. of dry laundry per cubic foot cylinder capacity may be figured for the washing process. Thus during 1 hr., in which one cycle is allowed, some 100 lbs. may be taken as the capacity of a 42-in. by 72-in. washer and 200 lbs. per hour may be estimated as the capacity of a high-duty washer of the same size. These figures are for dry weight, and the cycle includes loading, washing, rinsing, emptying and unloading.

Washers are rated on the diameter and length of the cylinder inside. For instance, the cylinder of a 42-in. by 72-in. machine is 42 in. diameter and 72 in. long, inside measurements.

Flat-Work Ironers

Capacity of flat-work ironers is determined by width of machine, number of rolls, steam pressure carried and efficiency of venting and draining steam and air.

The proportions given in the instances cited indicate the approximate number required in a laundry. It is not advisable to install a flat-work ironer having less than five rolls, especially when blankets are to be laundered, which is usually the case in a flat-work plant. Where there is a smaller number of rolls, too much material has to be run through twice and sometimes, more. In general, a six-roll flat-work ironer is preferable, although care must be taken to see that the length of the rolls is well above the width of the widest sheets to be ironed.

Flat-work ironers are rated on length of roll in inches and number of heated rolls. Thus, a "110 five-roll" machine has five rolls, each of which is 110 in. long.

Tumbler Dryers

The proportion of tumbler dryers to washers is established in the instances given. For an unusually large percentage of blankets and similar articles, larger tumbler dryers would be required, and in a locality where few blankets are used, they may be smaller.

Tumbler dryers are high-duty dryers for work that could be done in the dry rooms. Although not absolutely necessary, they are regarded as being practically indispensable nowadays.

Tumbler dryers are rated on diameter and length of cylinder for the reception of material to be dried. A 42 in. by 72 in. tumbler has a cylinder 42 in. in diameter and is 72 in. long.

Each of these machines is provided with a small hot-air fan as part of the machine with the outlet on the back, provision being always made for a duct the size of the air outlet to discharge out of doors. The lint often carried in this air makes its discharge into the rooms objectionable.

Water, Steam and Power Requirements

The minimum amount of water, steam and power required may be expected to average about 100 gals. of cold water, 80 gals. of hot water, 30 lbs. of steam and 1 KW. of electricity per 100 lbs. of clothes (dry). Average laundries will exceed these figures by 50% and small laundries by 100%.

The instantaneous demands for steam and water are much higher than the average demand, and many installations have had to provide an increased supply of hot water and steam, after being placed in operation.

Due to the heavy instantaneous demands, especially in a small laundry, it is well, wherever practicable, to obtain the supply from the main boiler plant where these drafts will not be felt. In this case, the amounts given in the accompanying table are satisfactory for a medium-sized flat-work laundry having standard washers. If high duty washers are used, they should be doubled.

Size of Washing Machine	Gals. Hot Water per Hour per Washer	Capacity in Storage Tank per Washer
Small	150	100
Medium	200	150
Large	300	200

If an individual boiler is installed for the laundry, or if, for any other reason, the load curve must be flattened out, the use of larger tanks and consequently, more storage, is necessary. Tanks double the sizes given in this table are often found necessary.

The average drying tumbler, as one which is 42 in. by 72 in., requires about 600 lbs. of steam per hour. Steam requirements of other machines and dry room combined do not exceed one-third that of the drying tumbler. Although washers have steam connections for which considerable steam is used, a reduced amount of hot water is used. In some cases, steam is likely to carry oil in suspension; hence, its use in washers is objectionable.

The maximum demand for electric feeders should be taken at full connected load for direct current, and for alternating current, the power to operate the largest washer should be added to the full connected load. The latter requirement is intended to provide for reversal of machines which is negligible with direct current but considerable for alternating current.

Washers require from 2 to 8 H.P. for drive, according to size, plus 100% for reversing when alternating current machines are used. Extractors require 2 to 5 H.P. to drive, depending upon size. Tumblers take from 3 to 6 H.P. to drive, flat-work ironers from ¾ to 2 H.P. and electric irons from 500 to 1000 watts.

The capacity required of the flat-work ironer largely fixes the steam pressure required, as all other machines may use steam at widely varying pressures without appreciably affecting their operation or capacity.

With a flat-work ironer of five or six rolls, 70 lbs. per sq. in. is generally sufficient, although pressures of 90 lbs. are sometimes necessary in order to get the full capacity from the machine. 60 lbs. is ample for the disinfector and small presses.

Pipe Sizes and System of Piping

The branches to each machine must be large enough to meet instantaneous requirements, but the steam and water mains need not exceed one-half the combined area of the branches, as more than two heavy machines are not likely to be drawing full capacity simultaneously.

Steam connections to washing machines are ¾ in. to 1 in., according to size; to tumblers 1 in. to 1¼ in.; to dry rooms, usually ¾ in.; to flat-work ironers ¾ in. to 1 in.; starch cookers ½ in. and to garment presses ½ in. Although there are several small connections to the disinfector, the main supply should be 1 in.

The main steam lines should be properly graded and drained. If run at laundry ceiling, as is usually the case, the vertical drops need not be dripped to the individual machines, for the coils and traps will take care of the condensation without any damage.

Return connections are made from all equipment except washers. Each coil or heating unit should be tapped separately through a thermostatic trap into a common return line which is vented and graded downward to a vented receiving tank.

A ½-in. return connection and ½-in. thermostatic trap is ample for any coil or heating unit except the tumbler, which should be ¾-in. return with ¾-in. thermostatic trap. A ½-in. return and thermostatic trap will serve the smallest size drying tumbler, however, and return mains having an area one-half the combined area of the branches is ample, ½ in. being the minimum pipe size.

Although it is sometimes necessary to run return mains along the laundry ceiling, this is not advisable, for in such cases mechanical instead of thermostatic traps *must* be used, the condensation being lifted from floor to the return by the steam pressure. Such a main should be vented and run by gravity to a vented receiving tank.

Cold and hot water connections to washers are 1½ in. to 2 in.; ½ in. to soap tank and starch cooker and ¾ in. to each laundry tray.

High duty washers usually have two connections, each being the same size as for corresponding machines of similar dimensions. The extra capacity of these washers is dependent upon quick filling.

The individual control valves on the hot and cold water connections are placed in a convenient location for operation.

Soft water is required for satisfactory laundering, hard water forming insoluble compounds of calcium, magnesium and iron with the addition of soap, which cling to the fibres and spot the material. So much more soap is required when hard water is used, that it is desirable to have a water softener.

A number of such systems have been developed during recent years and have been found to be very satisfactory.

For efficient operation, the arrangement of equipment must be given careful consideration, in order that it will fit in with the natural sequence of handling, from receiving to delivery.

Whenever possible, the laundry should be a separate building. The mistake has often been made of putting it on the second floor of the power house or in the basement of a dormitory. The ceilings of the building should be high, the rooms well ventilated by large windows and ample roof ventilators. Ventilating fans often are required.

All operations except those of receiving mending, storing and delivery should be carried on in one room, as with this arrangement, better lighting and ventilation may be obtained and the general efficiency is increased.

Typical Layout

Fig. 1 illustrates a layout of a laundry for a 750-bed tubercular hospital in which the following equipment was installed:

One 36-in. by 42-in. by 84-in. disinfector.
One 36-in. by 48-in. standard washer.
Two 42-in. by 72-in. washers.
Two 60-gal. soap tanks.
Two 30-in. extractors.
One 42-in. by 90-in. tumbler.
One 110-in. six-roll flat-work ironer.
Two 38-in. garment presses.
Two 49-in. garment presses.
One four-truck dry room and one extra truck.
Five hand ironing boards.
Six 8-lb. electric irons.
One 20-gal. starch cooker.
One 36-in. by 60-in. starch table.
Four laundry trays.
Four wringers attached to trays.
Two 36-in. by 108-in. wood tables for use in connection with flat-work ironer.
Four 24-in. by 30-in. truck tubs.
One electric sewing machine.

Built-in tables and shelves are provided in the mending and delivery rooms for storage and sorting. This arrangement makes it possible to disinfect material before reaching the laundry proper. The parallel passage of flat work through washers, extractors, tumblers and flat-work ironer with that of the laundry trays, dry room and presses guards against any contact of washed and unwashed materials.

In this case, steam is furnished from a central plant, the hot water tank being placed in a room at one corner of the building, below the laundry-room floor. The ceiling height is 22 ft., and 20 ventilators of the 36-in. size are provided in the roof. Mezzanine floors are to be found over the receiving and delivery sections in the two wings, in which toilet and locker rooms are located, in addition to the central electric control panel which regulates the machinery and lighting of the building.

A hot water heating tank of 400-gal. capacity, having a copper coil of 20 sq. ft. and operating on 65 lbs. of steam pressure, takes care of the hot water supply.

The waste from the washers and extractors is conducted into a trench in the concrete floor, 30 in. wide, 4½ in. deep at each end and 6 in. deep in the middle. An 8-in. drain in the middle, protected by raised grating, leads to the sewer. In this way, most of the lint, which might cause trouble, is caught in the grating. It is important that washers do not discharge directly into a sewer on account of the stoppage resulting.

Water and steam distribution lines run overhead with individual drops to machines. Returns have individual thermostatic traps at each coil or unit requiring return, and return mains are run below the concrete floors, encased in terra cotta pipes. The return mains are run by gravity back to a vented receiver in the power house some 500 ft. distant.

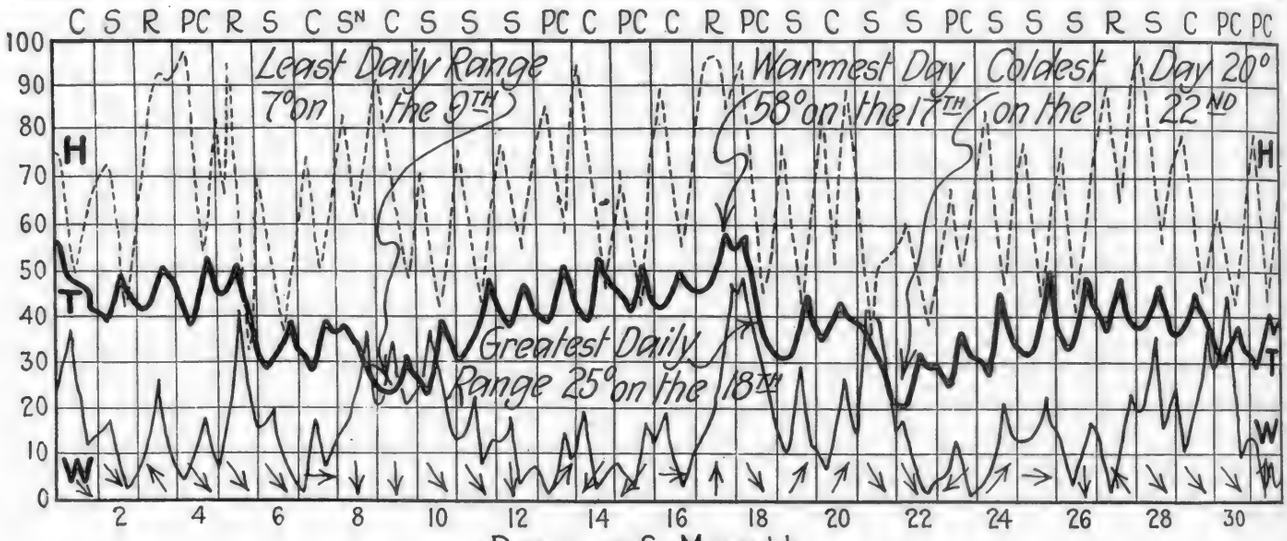
Heating is done by vacuum system, with mains running at ceiling and returns in trenches below concrete floors in the same manner as returns from laundry equipment, then back to vacuum pumps in the power house.

Plumbing Questions and Answers

The third edition of Plumbing Questions and Answers has been issued by the Scientific Book Corp., 15 East 26th Street, New York. For those readers who are engaged in plumbing as well as heating, this book will be of value. It contains useful information for master and journeyman plumbers, sanitary engineers, plumbing inspectors, architects, estimators and draftsmen, and is of especial interest to those engaged in this work in New York City and vicinity as it contains questions and answers based on the plumbing code of the City of New York. Standpipe and fire-line rules are discussed in a complete manner and a great deal of engineering data on plumbing is presented in the back. Size 5 in. x 7 in. Pp. 164. Price $2.

The Weather for December, 1928

	New York	Boston	Pittsburgh	Chicago	St. Louis
Highest temperature, degrees F.	58	61	58	50	75
Date of highest temperature	17	18	13	11	28
Lowest temperature, degrees F.	20	17	10	3	16
Date of lowest temperature	22	22	21	21	5
Greatest daily range, degrees F.	25	27	26	19	35
Date of greatest daily range	18	18	5	11	28
Least daily range, degrees F.	7	5	3	3	4
Date of least daily range	9	3	1	15	14
Mean temperature for month, degrees F.	39	38	36	32	39
Normal mean temp. for month, degrees F.	35	32	34	29	35
Total precipitation, this month, inches	0.85	2.61	1.18	2.63	2.22
Total snowfall, this month, inches	2.3	4.6	Trace	3.6	Trace
Normal precipitation, this month, inches	3.62	3.45	2.86	2.04	2.21
Total wind movement, this month, miles	10,799	6,669	6,036	6,500	8,030
Average hourly wind velocity, miles	14.5	8.7	8.1	8.7	10.8
Prevailing direction of wind	N.W.	W.	S.W.	S.W.	S.
Number of clear days	10	15	10	8	9
Number of partly cloudy days	10	8	8	6	9
Number of cloudy days	11	8	13	17	13
Number of days with precipitation	7	11	7	15	9
Number of days with snowfall	1	3	1	7	1
Snow on ground at end of month	None	None	None	0.1	None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Warmest Day 58° on the 17TH
Coldest Day 20° on the 22ND
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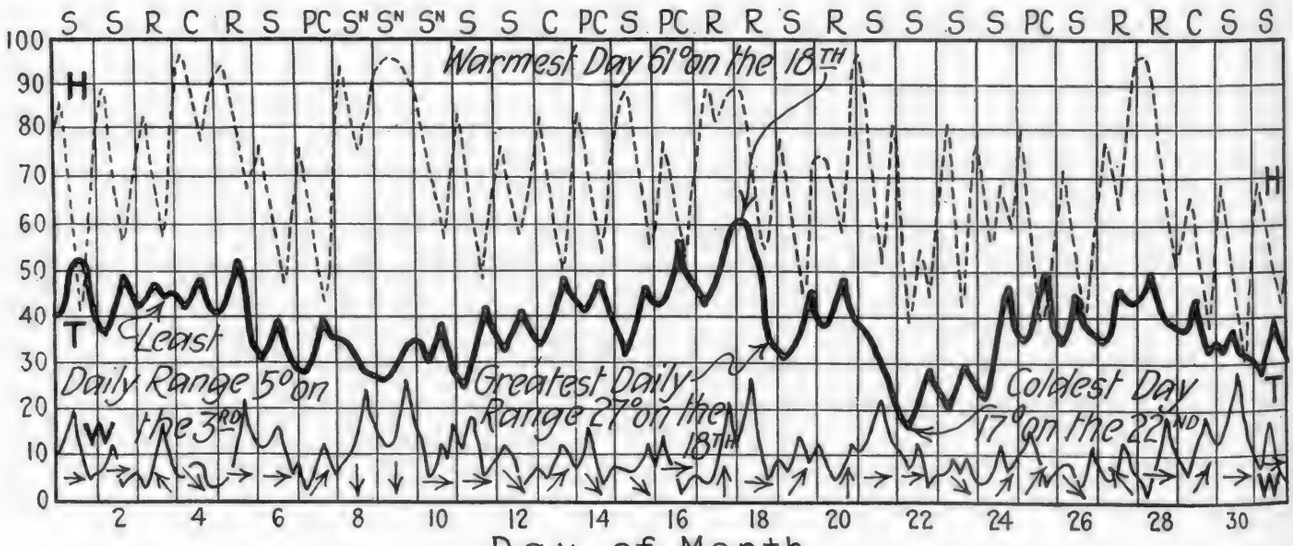
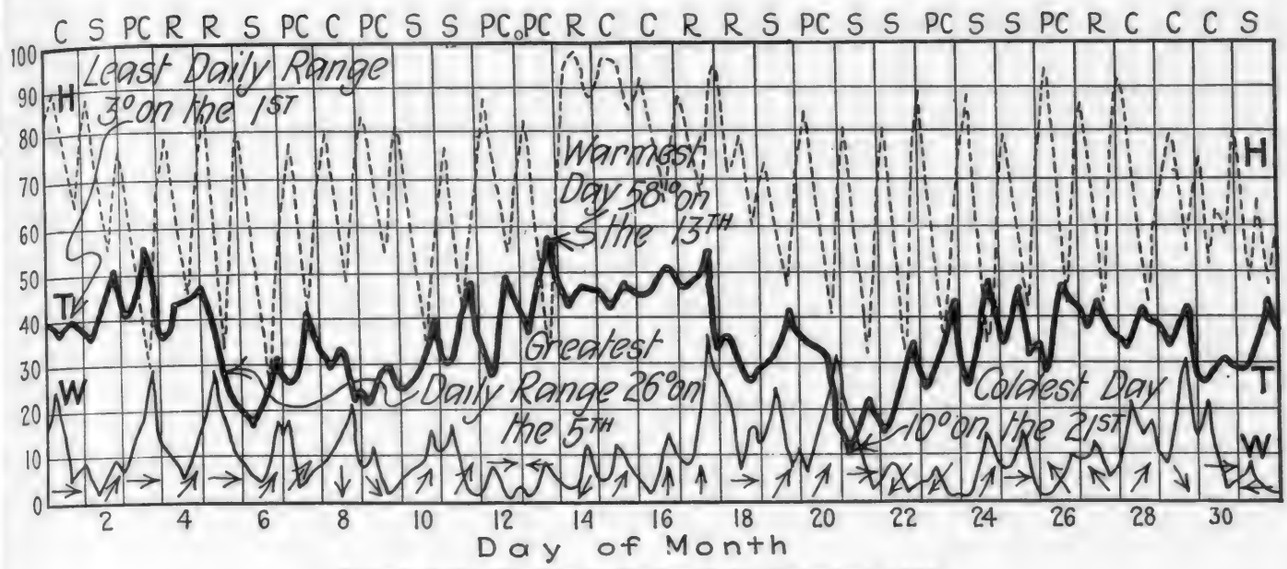
Day of Month

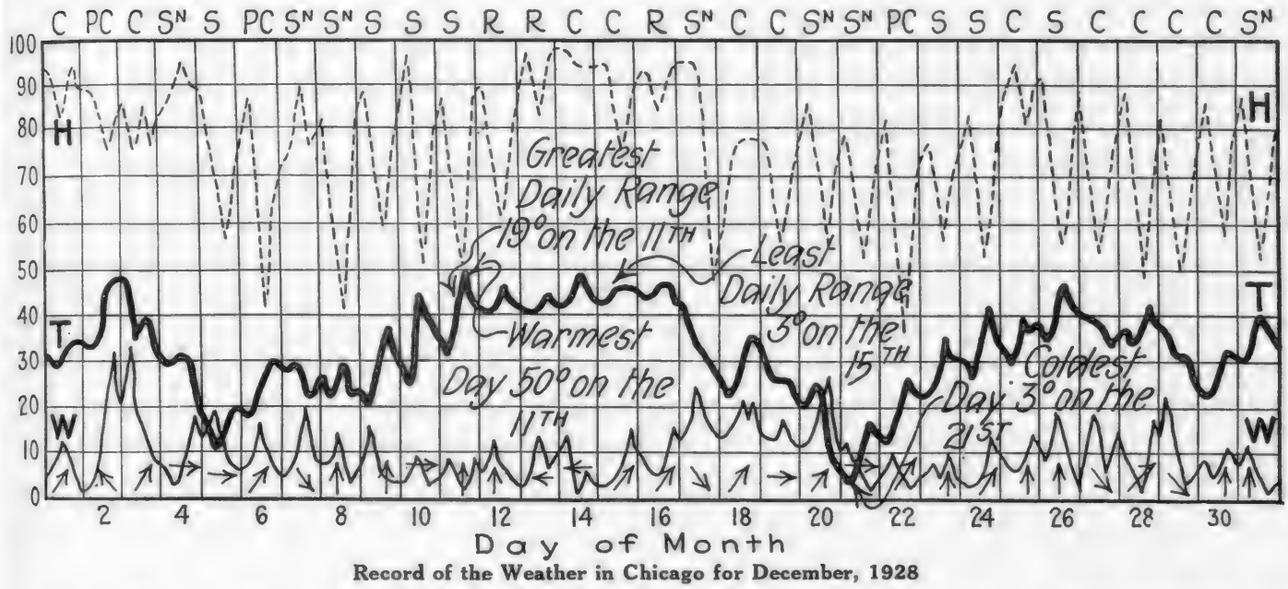
Record of the Weather in New York for December, 1928
(Hourly Observations of the Relative Humidity Plotted on this Chart)


S S R C R S PC SN SN SN S S C PC S PC R R S R S S S S PC S R R C S S
Warmest Day 61° on the 18TH
Least Daily Range 5° on the 3RD
Greatest Daily Range 27° on the 18TH
Coldest Day 17° on the 22ND
H
T
W
100
90
80
70
60
50
40
30
20
10
0
2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
Day of Month

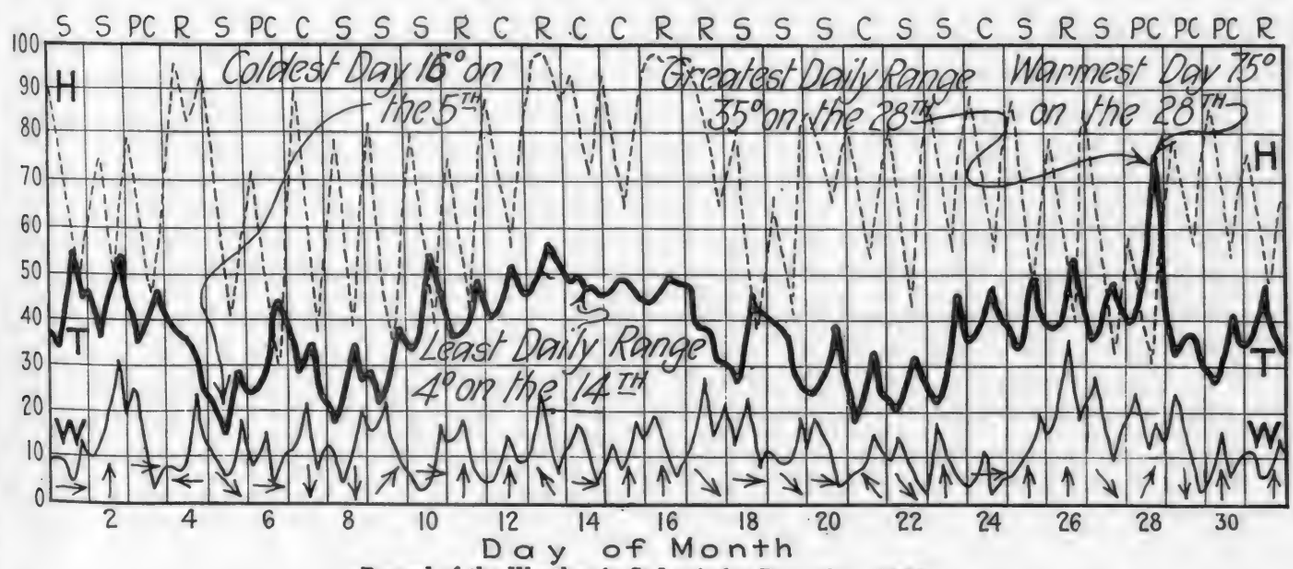
Record of the Weather in Boston for December, 1928


C S PC R R S PC C PC S S PC PC R C C R R S PC S S PC S S PC R C C C S
Least Daily Range 3° on the 1ST
Warmest Day 58° on the 13TH
Greatest Daily Range 26° on the 5TH
Coldest Day 10° on the 21ST
H
T
W
Day of Month

Record of the Weather in Pittsburgh for December, 1928


C PC C SN S PC SN SN S S S R R C C R SN C C SN SN PC S S C S C C C C SN
Greatest Daily Range 19° on the 11TH
Least Daily Range 3° on the 15TH
Warmest Day 50° on the 7TH
Coldest Day 3° on the 21ST
H
T
W
Day of Month

Record of the Weather in Chicago for December, 1928


S S PC R S PC C S S S R C R C C R R S S S C S S C S R S PC PC PC R
Coldest Day 16° on the 5TH
Greatest Daily Range 35° on the 28TH
Warmest Day 75° on the 28TH
Least Daily Range 4° on the 14TH
H
T
W
Day of Month

Record of the Weather in St Louis for December, 1928

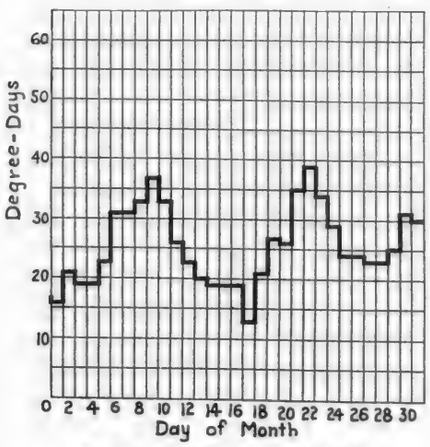
Plotted from records especially compiled for The HEATING AND VENTILATING MAGAZINE by the United States Weather Bureau.
Heavy lines indicate temperatures in degree F. Light lines indicate wind in miles per hour.
Broken lines indicate humidity in percentage from readings at 8 A.M., 12 M., and 8 P.M. Arrows fly with prevailing directions of the wind.
C—clear, PC—partly cloudy, C—cloudy, R—rain, Sn—snow.

Monthly Heating Load in Degree-Days in Nine Typical Cities

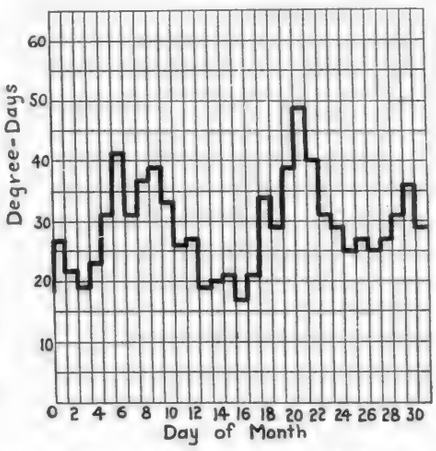
IN order that the degree-day charts may be available for all parts of the country, THE HEATING AND VENTILATING MAGAZINE is publishing the heating loads and degree-days for 9 cities, which may be taken as typical of the degree-day bands north of Washington, D. C. Charts for any location easily can be prepared from data furnished by the local weather bureau station.

These graphs can be pasted together so that at the end of the season, the annual heating load is presented in such form as to show the monthly heating demand at a glance. This material is of value to heating contractors, heating appliance salesmen, house-heating manufacturers of gas companies and others interested in fuel consumption.

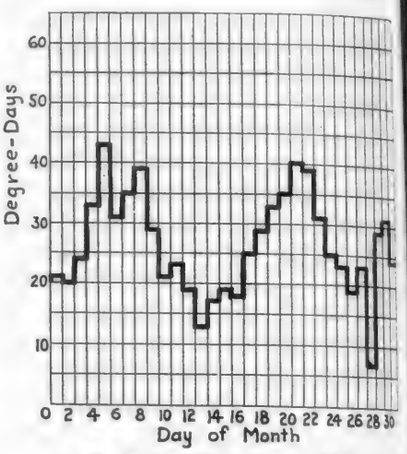
The number of degree-days per day is found by subtracting the average daily outside temperature from 65°. Thus when the average outside temperature is 62°, there are 3 degree-days for that day.



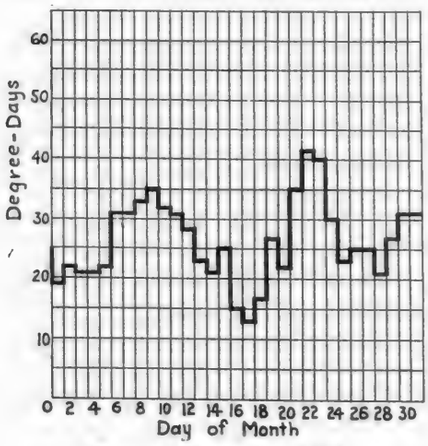
New York, December, 1928
Degree-Days 793—Degree-Days to Date 1706



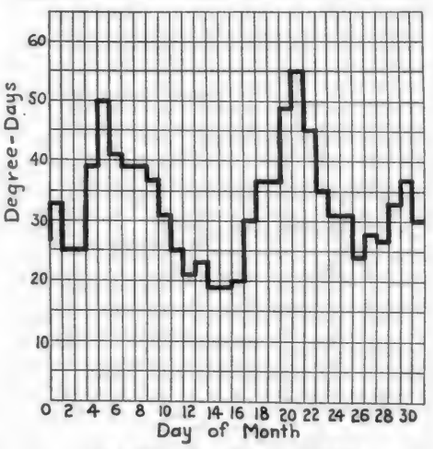
Pittsburgh, December, 1928
Degree-Days 905—Degree-Days to Date 2003



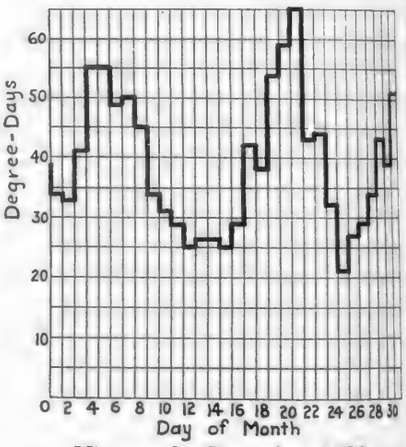
St. Louis, December, 1928
Degree-Days 818—Degree-Days to Date 1641



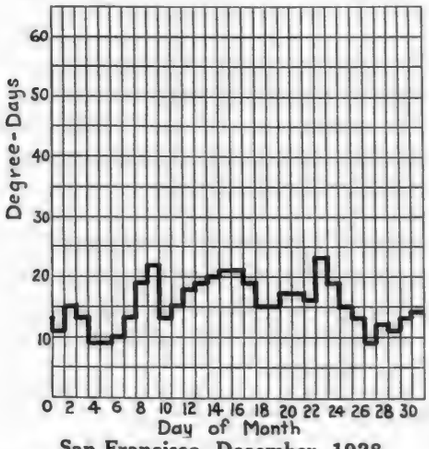
Boston, December, 1928
Degree-Days 819—Degree-Days to Date 1847



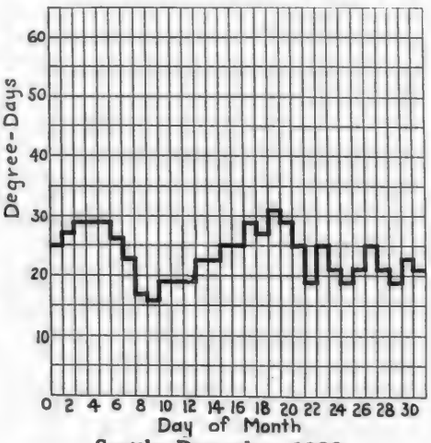
Chicago, December, 1928
Degree-Days 1015—Degree-Days to Date 2174



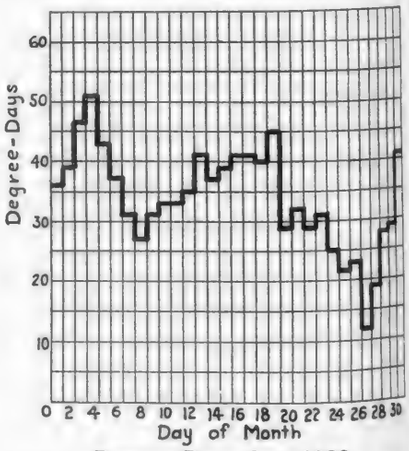
Minneapolis, December, 1928
Degree-Days 1208—Degree-Days to Date 2786



San Francisco, December, 1928
Degree-Days 476—Degree-Days to Date 1085



Seattle, December, 1928
Degree-Days 729—Degree-Days to Date 1881



Denver, December, 1928
Degree-Days 1047—Degree-Days to Date 2382

Number of Gas Companies Promoting House Heating Shows Significant Growth

GAS companies promoting the sale of gas for house heating have shown a remarkable increase in number during the past year as is evidenced by the summary of the companies lining up for the house-heating load, which was published as part of the report of the House Heating Committee of the American Gas Association, and presented at its annual convention in Atlantic City, October 8-12. The 1927 summary, compiled by the same committee, was published in THE HEATING AND VENTILATING MAGAZINE for December, 1927, and a comparison of that summary with the one here presented is significant. It will be noted that the number of companies promoting gas for house heating has increased from 156 to 237. This increase is divided among the different states as is shown in the table at the right.

In addition to the companies listed in the tabulations on this and the succeeding pages, the following are starting to promote house heating:

Public Utilities Consolidated Corp., Nogales, Ariz.
Southern Counties Gas Co. of California, Los Angeles, Cal.
Coast Counties Gas & Electric Co., San Francisco, Cal.
United Gas & Fuel Co., Hamilton, Can.
Eastern Connecticut Power Co., Putnam & Danielson, Conn.
Georgetown Gas Co., Georgetown, Del.
Public Utilities Consolidated Corp., Pocatello, Idaho.
Princeton Gas Co., Princeton, Ill.
Rockford Gas Light & Coke Co., Rockford, Ill.
Northern Indiana Fuel & Light Co., Auburn, Ind.
Iowa Public Service Co., Fort Dodge, Iowa.
Ottumwa Gas Co., Ottumwa, Iowa.
The Prairie Oil and Gas Co., Independence, Kan.
Cumberland and Allegheny Gas Co., Cumberland, Md.
Adams Gas Light Co., Boston, Mass.
Citizens' Gas Electric and Power Co., Nantucket, Mass.
Clinton Gas Light Co., Clinton, Mass.
Leominster Gas Light Co., Leominster, Mass.
North Attleboro Gas Light Co., North Attleboro, Mass.
Northampton Gas Light Co., Northampton, Mass.
Holland Gas Co., Holland, Mich.
Michigan Federated Utilities, Sault Ste. Marie Division, Sault Ste. Marie, Mich.
Citizens Gas Co., Hannibal, Mo.
Saugerties Gas Light Co., Saugerties, N. Y.
Gastonia and Suburban Gas Co., Gastonia, N. C.
Tide Water Power Co., Wilmington, N. C.
Carbondale Gas Co., Carbondale, Pa.
Chambersburg Gas Co., Chambersburg, Pa.
Lock Haven Gas and Coke Co., Lock Haven, Pa.
Pennsylvania Power and Light Co., Allentown, Pa.
Pottsville Gas Co., Pottsville, Pa.
Austin Gas Co., Austin, Texas.
Consumers Utilities Co., Staunton, Va.
Consumers Utilities Co., Winchester, Va.
The Petersburg Gas Co., Petersburg, Va.
Martinsburg Heat & Light Co., Martinsburg, W. Wa.
Wisconsin Michigan Power Co., Appleton, Wis.
Wisconsin Gas and Electric Co., Watertown, Wis.

COMPARATIVE GROWTH OF COMPANIES PROMOTING HOUSE HEATING WITH GAS 1927-1928

	1927	1928
California	3	3
Colorado	1	3
Connecticut	9	14
Delaware	0	1
Florida	1	2
Georgia	2	2
Illinois	25	25
Indiana	7	14
Iowa	7	8
Kansas	1	0
Kentucky	0	0
Louisiana	0	1
Maine	2	4
Maryland	1	2
Massachusetts	18	24
Michigan	9	9
Minnesota	0	2
Missouri	3	4
Montana	0	1
Nebraska	1	3
Nevada	1	1
New Hampshire	5	7
New Jersey	5	6
New York	16	21
Ohio	2	8
Oklahoma	0	2
Oregon	1	2
Pennsylvania	10	14
Rhode Island	4	4
Tennessee	1	5
Texas	0	3
Utah	1	1
Vermont	2	3.
Virginia	2	2
Washington	4	5
West Virginia	0	1
Wisconsin	5	18
Wyoming	1	0
District of Columbia	1	1
Canada	5	11
	156	237

SUMMARY OF GAS COMPANIES PROMOTING SALES OF HOUSE HEATING

Town	*Gas Company*	*Total Steam, Hot Water and Vapor*	*Total Warm Air*	*Steam Hot Water and Vapor Conversions*	*Warm Air Conversions*	*Total Installations*	*Total Consumption in Million cu.ft.*
		CALIFORNIA					
Los Angeles	Los Angeles Gas & Electric Corp.			Impossible to determine			1,750. of 1100 B.t.u. gas for house heating
Los Angeles	Southern California Gas Co.	54	(1)			54[1]	80.
San Diego	Consolidated Gas & Electric Co.	55	900	15	0	955	100.
		COLORADO					
Boulder	Public Service Co. of Colorado	4	0	2	0	4	2.368
Colorado Springs	City of Colorado Springs Light & Power Dept.	5	1	0	0	6	2.5
Pueblo	Pueblo Gas & Fuel Co.	36	136[2]	35	80	172[2]	
		CONNECTICUT					
Bridgeport	Bridgeport Gas Light Co.	38	6	1	1	44	22.807
Bristol	The Connecticut Light & Power Co.	9	0	0	0	9	23.7
Meriden	The Connecticut Light & Power Co.	37	6	2	0	43	23.7
Middletown	The Connecticut Light & Power Co.	2	0	0	0	2	23.7
Norwalk	The Connecticut Light & Power Co.	16	9	0	0	25	23.7
Danbury	Danbury & Bethel Gas & Electric Light Co.	26	5	4	0	31	25.150
Derby	Derby Gas & Electric Co.	8	4	0	0	12	9.522
Hartford	Hartford Gas Co.	92	4	0	0	96	33.255
New Haven	New Haven Gas Light Co.	110	31	Few	0	141[3]	61.944
New London	Connecticut Power Co.	71	2	1	0	73	24.312[1]
Norwich	City of Norwich Gas & Electric Dept.	5	1	1	0	6	4.878.[4]
Stamford	Stamford Gas & Electric Co.	88	0	0	0	88	40.
Thompsonville	The Northern Connecticut Power Co.	2	0	0	0	2	.994
Willimantic	The Rockville-Willimantic Lighting Co.	1	0	0	0	1	

[1]Gas so universally used for house heating impossible to determine warm air furnace installations.
[2]Includes 32 space heater installations.
[3]Gas Company sales only.
[4]Includes several radiator installations.

SUMMARY OF GAS COMPANIES PROMOTING SALE OF HOUSE HEATING—(Continued)

Town	Gas Company	Total Steam, Hot Water and Vapor	Total Warm Air	Steam, Hot Water and Vapor Conversions	Warm Air Conversions	Total Installations	Total Consumption in Million cu.ft.
		DELAWARE					
Wilmington	Wilmington Gas Co.	40	3	0	0	43	18.
		FLORIDA					
Jacksonville	Jacksonville Gas Co.	45	3	0	0	48	
St. Augustine	St. Augustine Gas & Electric Light Co.	3	0	0	0	3	.201
		GEORGIA					
Atlanta	Georgia Power Co.	4	1	0	0	5	2.823
Columbus	Columbus Electric & Power Co.	1	0	0	0	1	.285
		ILLINOIS					
Aurora	Western United Gas & Electric Co.	167	89	2	2	256	120.
[5]Belleville	Illinois Power & Light Corp.	4	7	0	0	11	2.551
[5]Carlinville	Illinois Power & Light Corp.	1	0	0	0	1	.050
[5]Champaign	Illinois Power & Light Corp.	23	21	14	16	44	18.
[5]Danville	Illinois Power & Light Corp.	10	2	0	0	12	3.849
[5]East St. Louis	Illinois Power & Light Corp.	42[6]	19	0	1	61	15.131
[5]Galesburg	Illinois Power & Light Corp.	9	7	0	0	16	7.2
[5]Granite City	Illinois Power & Light Corp.	7	0	0	0	7	5.767
[5]Jacksonville	Illinois Power & Light Corp.	5	3	0	0	8	10.55
[5]La Salle	Illinois Power & Light Corp.	11	1	0	0	12	12.849
[5]Mt. Vernon	Illinois Power & Light Corp.	1	0	0	0	1	.354
Bloomington	Union Gas & Electric Co.	3	9	0	1	12	3.
Chicago	North American Light & Power Co. Includes: Des Moines Gas Co. Illinois Power & Light Iowa Power & Light Kansas Power & Light Missouri Power & Light United Power & Light	120	218[6]	11	102	338[6]	91.189
Chicago	The Peoples Gas Light & Coke Co.	1657	574	46	10	2231	900.
Chicago	Public Service Co. of Northern Illinois	1389	200	20	0	1589	500.
Freeport	Illinois Public Utility Co.	7	16	0	0	23	10.
Moline	Peoples Power Co.	5	9	0	0	14	3.388
Peoria	Central Illinois Light Co.	18	42	0	0	60	22.28
Springfield	Central Illinois Public Service Co. Service rendered in following towns: Beardstown, Canton, Charleston, Hoopeston, Macomb, Mattoon, Pana, Paris, Quincy, Shelbyville, Taylorville	40	40	0	0	80	29.418
Springfield	Illinois Power Co.	11	5	0	0	16	8.393
		INDIANA					
Anderson, Marion, Muncie	Central Indiana Gas Co.	5	2	0	0	7	4.263
Elkhart	Northern Indiana Public Service Co.	7	11	0	0	18	4.7
Evansville	Southern Indiana Gas & Electric Co.	4	4	0	0	8	4.
Ft. Wayne	Northern Indiana Public Service Co.	25	35	0	3	60	27.394
Goshen	Interstate Public Service Co.	4	1	0	0	5	4.443
Hammond	Northern Indiana Public Service Co.	43	32	0	0	75	37.5
Indianapolis	Citizens Gas Co.	5	3	0	0	8	2.5
Indianapolis	Interstate Public Service Co.	17	9	0	0	26	
LaPorte	LaPorte Gas & Electric Co.	3	1	0	0	4	1.002
New Albany	Interstate Public Service Co.	1	1	1	0	2	1.026
Terre Haute	Indiana Gas Utilities Co.	20	27	3	0	47	17.618
Vincennes	Central States Gas Co.	7	3	0	0	10	4.1
Warsaw	Interstate Public Service Co.	3	2	0	0	5	.852
Washington	Washington Gas & Coke Co.	1	1	0	0	2	.250
		IOWA					
Cedar Rapids	Cedar Rapids Gas Co.	10	12	0	0	22	8.646
Creston	Creston Gas Co.	1				1	.050
Davenport	Peoples Light Co.	6	3	0	0	9	4.054
Fort Dodge	Fort Dodge Gas & Electric Co.	0	3	0	0	3	1.133
Iowa City	Iowa City Light & Power Co.	2	2	0	0	4	1.4
Le Mars	Le Mars Gas Co.	1	2	1	2	3	.550
Sioux City	Sioux City Gas & Electric Co.	3	0	0	0	3	8.9
Des Moines	Des Moines Gas Co.	2	0	0	0	2	1.3
		KENTUCKY					
Covington	See Ohio						
		LOUISIANA					
Baton Rouge	Baton Rouge Electric Co.	46	10	30	8	56	12.
		MAINE					
Augusta	Central Maine Power Co.	5	0	0	0	5	4.442
Lewiston	Lewiston Gas Light Co.	10	1	0	0	11	5.554
Portland	Portland Gas Light Co.	77	9	0	0	86	76.209 (58 jobs only)
Westbrook	Westbrook Gas Co.	2	0	0	0	2	.900
		MARYLAND					
Baltimore	Consolidated Gas Electric Light & Power Co.	1664	92	89	9	1756	800.
Salisbury	Citizens Gas Co.	0	3	0	3	3	.150
		MASSACHUSETTS					
Arlington	Arlington Gas Light Co.	7	0	1	0	7	1.960
Boston	Boston Consolidated Gas Co.	552	113	18	5	665	259.632
Brockton	Brockton Gas Light Co.	95	1	0	0	96	48.
Cambridge	Cambridge Gas Light Co.	20	4	0	0	24	15.915
Charlestown	Charlestown Gas & Electric Co.	2	0	0	0	2	.802
East Braintree	Old Colony Gas Co.	26	5	0	0	31	9.751
Fall River	Fall River Gas Works Co.	131	16	1	0	147	51.266
Fitchburg	Fitchburg Gas & Electric Co.	16	1	0	0	17	7.543
Haverhill	Haverhill Gas Light Co.	213	22	0	0	235	98.
Hyde Park	Dedham & Hyde Park Gas & Electric Light Co.	4	2	0	1	6	2.5
Lawrence	Lawrence Gas & Electric Co.	37	3	5	0	40	24.058
Lowell	Lowell Gas Light Co.	67	6	0	0	73	39.936

[5]Illinois Power & Light Corporation also covered under North American Light & Power Co., Chicago.
[6]Includes 21 gas-steam radiators not listed.

SUMMARY OF GAS COMPANIES PROMOTING SALE OF HOUSE HEATING—(continued)

Town	Gas Company	Total Steam, Hot Water and Vapor	Total Warm Air	Steam, Hot Water and Vapor Conversions	Warm Air Conversions	Total Installations	Total Consumption in Million cu.ft.
		MASSACHUSETTS—Continued					
Lynn	Lynn Gas & Electric Co.	95	31	26	0	126	56.680
Malden	Malden & Melrose Gas Light Co.	53	14	1	0	67	20.000
Marlborough	Marlborough-Hudson Gas Co.	4	0	0	0	4	3.
New Bedford	New Bedford Gas & Edison Light Co.	151	27	11	3	178	49.794
Newburyport	Haverhill Electric Co.	0	2	0	0	2	.799
Norwood	Norwood Gas Co.	4	0	4	0	4	3.230
Pittsfield	Pittsfield Coal Gas Co.	23	2	0	0	25	7.5
Plymouth	Plymouth Gas Light Co.	4	2	0	0	6	2.584
Salem	Salem Gas Light Co.	2	0	1	0	2	.500
Springfield	Springfield Gas Light Co.	90	9	0	0	99	55.
Webster	Webster & Southbridge Gas & Electric Co.	2	0	0	0	2	.550
Worcester	Worcester Gas Light Co.	126	25	3	0	151	76.520
		MICHIGAN					
Adrian	Citizens Gas Fuel Co.	7	0	2	0	7	6.919
Albion	Albion Gas Light Co.	0	1	0	0	1	.532
Ann Arbor	Washtenaw Gas Co.	15	20	0	0	35	
Grand Haven	Central States Utilities Co.	1	0	0	0	1	.685
Grand Ledge	Consumers Power Co.	1	1	0	0	2	
Grand Rapids	Grand Rapids Gas Light Co.	11	5	0	0	16	6.827
Marshall	Michigan Federated Utilities	2	1	2	1	3	Just installed
Marinette, Menominee	Menominee & Marinette Light & Traction Co.	3	5	0	0	8	3.838
Muskegon	Muskegon Traction & Lighting Co.	4	1	4	0	5	2.1
		MINNESOTA					
Minneapolis	Minneapolis Gas Light Co.	181	12	30	5	193	82.
St. Paul	Northern States Power Co.	81	4	2	1	85	28.
		MISSOURI					
Joplin	Joplin Gas Co.	45	275	20	250	320	16.
Kansas City	Kansas City Gas Co.	450	2000	400	1800	2450	300.
St. Louis	Laclede Gas Light Co.	394	34	1	0	428	183.
Webster Groves	The St. Louis County Gas Co.	319	25	0	0	344	158.122
		MONTANA					
Great Falls	Great Falls Gas Co.	31	69	25	51	100	2. for Man. Gas 10½ mos. and .500 Nat. Gas 1½ mos.
		NEBRASKA					
Grand Island	Central Power Co.	1	6	0	0	7	2.375
Lincoln	Iowa-Nebraska Light & Power Co.	1	4	0	0	5	2.173
Omaha	Metropolitan Utilities Dist.	23	98	1	0	121	31.736
		NEVADA					
Reno	Sierra Pacific Power Co.	2	2	0	0	4	.700
		NEW HAMPSHIRE					
Concord	Concord Gas Co.	38	0	0	0	38	20.
Dover	Twin State Gas & Electric Co.	5	1	0	0	6	2.890
Keene	Public Service Co. of New Hampshire	7	1	0	0	8	3.
Manchester	Manchester Gas Co.	26	1	1	0	27	18.130
Nashua	Public Service Co. of New Hampshire	17	0	1	0	17	5.578
Portsmouth	Portsmouth Gas Co.	7	4	0	0	11	6.
Rochester	Strafford-York Gas Co.	2	0	1	0	2	
		NEW JERSEY					
Atlantic City	Atlantic City Gas Co.	150	0	5	0	150	45.
Atlantic Highlands	County Gas Co.	20	0	0	0	20	9.
Asbury Park	Jersey Central Power & Light Co.	214	2	0	0	216	80.5
Newark	Public Service Electric & Gas Co.	472	33	8	1	505	200.
Salem	Salem Gas Light Co.	2	0	0	0	2	.8117
Washington	New Jersey Power & Light Co.	10	0	10	0	10	
		NEW YORK					
Amsterdam	Chuctanunda Gas Light Co.	16	2	0	0	18	11.7
Brooklyn	Brooklyn Union Gas Co.	354	5	8	2	359	143.6
Brooklyn	Kings County Lighting Co.	88	7	3	0	95	46.140
[1]Buffalo	Dominion Natural Gas Co. Ltd., Republic Light Heat & Power Co.	464	457	423	366	921	299.581
Geneva	Empire Gas & Electric Co.	5	2	0	1	7	2.5
Glens Falls	New York Power & Light Corp.	7	0	0	0	7	
Lockport	Lockport Light Heat & Power Co.	3	4	2	4	7	1.603
Mechanicville	Eastern New York Electric & Gas Co., Inc.	3	2	0	0	5	2.
Middletown	Rockland Light & Power Co.	6	3	0	0	9	2.027
New York	Consolidated Gas Co. of N. Y. & Affiliated Cos.	581	13	13	1	594	487.628
New York	Federal Light & Traction Co.	6	2	6	0	8	2.7
Niagara Falls	Niagara Falls Gas & Elctric Light Co.	27	13	25	13	40	17.140
Poughkeepsie	Central Hudson Gas & Electric Corp.	50	7	0	0	57	22.8
Rochester	Rochester Gas & Electric Corp.	166	136	3	5	302	164.657
Saratoga Springs	New York Power & Light Corp.	9	2	0	0	11	5.583
Schenectady	New York Power & Light Corp.	104	31	0	0	135	54.00
Stapleton	New York & Richmond Gas Co.	14	1	2	0	15	5.5
Syracuse	Syracuse Lighting Co., Inc.	18	17	0	9	35	19.6
Tonawanda	Republic Light, Heat & Power Co.	170	55	155	50	225	101.250
Watertown	Northern New York Utilities, Inc.	2	0	0	0	2	2.488
		OHIO					
Columbus	Columbia Gas & Electric Corp. (Columbus Group).	2,741	7,401	857	1,953	10,142	2,028.4
Lima	West Ohio Gas Co.	10	10	2	2	20	5.750
Cincinnati, Covington, Ky., Miamisburg, Middletown	Union Gas & Electric Co., Union Light, Heat & Power Co., Columbia Gas Supply Co., Union Gas & Electric Co.	3,084	6,947	1,842	5,625	10,031	2,507.750
Portsmouth	Portsmouth Gas Co.	125	475	100	275	600	150.
Wilmington	Dayton Power & Light Co.	3	12		9	15	1.2
		OKLAHOMA					
Bartlesville	Bartlesville Gas & Electric Co.						[2]
Walters	Community Natural Gas Co.	0	4	0	0	4	.420

[1] Includes few radiators.
[2] Total figure for both companies; also listed individually for towns served.
[3] All houses heated with gas.

SUMMARY OF GAS COMPANIES PROMOTING SALE OF HOUSE HEATING—(continued)

Town	Gas Company	Total Steam, Hot Water and Vapor	Total Warm Air	Steam, Hot Water and Vapor Conversions	Warm Air Conversions	Total Installations	Total Consumption in Million cu. ft.
		OREGON					
Eugene	Mountain States Power Co.	1	10	0	0	11	1.064
Portland	Portland Gas & Coke Co.	626	10,164	22	4	10,790[10]	1,334.815
		PENNSYLVANIA					
Easton	Easton Gas Works	1	0	0	0	1	.407
Johnstown	Johnstown Fuel Supply Co.	34	0	5	0	34	7.718
Lebanon	Lebanon Valley Gas Co.	8	0	0	0	8	2.915
Lewistown	Penn Central Light & Power Co.	12	2	0	0	14	
[11]Pittsburgh	Columbia Gas & Electric Co. (Pittsburgh Group)	183	51			234	
Pittsburgh	Equitable Gas Co.	5,100	10,100	1,700	3,800	15,200	9,500.
Pittsburgh	Peoples Natural Gas Co.			Not known		9,027	
Philadelphia	Northern Liberties Gas Co.	7	0	0	0	7	3.170
Philadelphia	Philadelphia Gas Works Co.	1,050	65	0	0	1,115	400.
Reading	Consumers Gas Co.	11	1	0	0	12	4.029
Red Lion	Interborough Gas & Fuel Co.	1	0	1	0	1	.540
Scranton	Springbrook Water Service Co.	36	2	1	0	38	23.1
Waynesboro	Waynesboro Gas Co.	2	0	0	0	2	.865
York	Pennsylvania Gas & Electric Co.	25	1	0	0	26	14.294
		RHODE ISLAND					
Pawtucket	Pawtucket Gas Co.	341	34	3	2	375	155.305
Woonsocket	Blackstone Valley Gas & Electric Co.	341	34	3	2	375	155.305
Providence	Providence Gas Co.	168	38	0	0	206	82.647
Westerly	South County Public Service Co.	3	0	0	0	3	3.280
		TENNESSEE					
Bristol	Bristol Gas & Electric Co.	1	0	0	0	1	.764
Chattanooga	Chattanooga Gas Co.	4	2	0	0	6	3.751
Johnson City	Washington County Gas Co.	2	0	0	0	2	1.2
Knoxville	Knoxville Gas Co.	19	2	1	2	21	12.980
Memphis	Memphis Power & Light Co.	1	0	0	0	1	
		TEXAS					
Austin	Austin Gas Co.	7	38	6	29	45	6.650
Marlin	Community Natural Gas Co.	7	0	0	0	7	
San Antonio	San Antonio Public Service Co.	132	107	127	97	239	38.133
		UTAH					
Salt Lake City	Utah Gas & Coke Co.	51	82	2	0	133	93.282
		VERMONT					
Bennington	Twin State Gas & Electric Co.	3	6	0	4	9	2.322
Brattleboro	Twin State Gas & Electric Co.	5	5	0	4	10	2.973
Rutland	Rutland Railway Light & Power Co.	5	2	0	0	7	10.250
		VIRGINIA					
Norfolk	City Gas Co. of Norfolk	2	0	0	0	2	2.050
Richmond	Dept. of Public Utilities	4	0	0	0	4	
		WASHINGTON					
Bellingham	Puget Sound Power & Light Co.	3	50	0	0	53	7.
Seattle	Seattle Lighting Co.	35	475	1	1	510[12]	86.042
Spokane	Spokane Gas & Fuel Co.	7	25	1	0	32	19.2
Tacoma	Washington Gas & Electric Co.	40	124	2	0	164	
Wenatchee	Puget Sound Power & Light Co.	3	4	0	0	7	1.548
		WEST VIRGINIA					
Bluefield	Bluefield Gas & Power Co.	1	0	0	0	1	.100
		WISCONSIN					
Beloit	Wisconsin Power & Light Co.	3	3	0	0	6	2.5
Fond du Lac	Wisconsin Power & Light Co.	7	2	0	0	9	5.
Green Bay	Wisconsin Public Service Corp.	6	7	0	1	13	4.421
Kenosha	Wisconsin Gas & Electric Co.	1	4	0	0	5	1.6
Madison	Madison Gas & Electric Co.	22	12	0	0	34	16.550
Marinette Menominee	Menominee & Marinette Light & Traction Co.				See Michigan		
Milwaukee	Lakeshore Gas Co.	15	1	0	0	16	10.507
Milwaukee	Milwaukee Gas Light Co.	313	117	0	0	430	167.071
North Milwaukee	Wisconsin Eastern Gas Co.	1	1	0	0	2	1.419
Oshkosh	Wisconsin Public Service Corp.	15	4	0	0	19	8.985
Sheboygan	Wisconsin Public Service Corp.	11	14	1	1	25	8.675
Superior	Superior Water Light & Power Co.	4	0	1	0	4	1.549
Two Rivers	Wisconsin Public Service Corp.	1	0	0	0	1	.365
Watertown	Wisconsin Gas & Electric Co.	1	0	0	0	1	
Wauwatosa	Wauwatosa Gas Co.	19	11	0	0	30	13.489
Waukesha	Wisconsin Gas & Electric Co.	1	0	0	0	1	
West Allis	West Allis Gas Co.	1	3	0	0	4	1.378
		DISTRICT OF COLUMBIA					
Washington	Washington Gas Light Co.	301	6	0	0	307	97.0
		CANADA					
Edmonton, Alb.	Northwestern Utilities, Limited	178	3,800	175	3,800	3,978	962.0
Vancouver, B. C.	British Columbia Electric Power & Gas Co.,	168	400	0	0	568	180.0[13]
Winnipeg, Man.	Winnipeg Electric Co.	30	6	1	0	36	24.788
Moncton, N. B.	Moncton Tramways, Electricity & Gas Co.,	131	260	0	0	391	12.25
Halifax, N. S.	Nova Scotia Light & Power Co., Limited	3	0	0	0	3	2.046
Dundas, Ont.	Dominion Natural Gas Co., Limited	19	15	19	10	44	10.962
Dunnville	Dominion Natural Gas Co., Limited	13	26	12	11	39	10.685
Ingersoll	Dominion Natural Gas Co, Limited	9	6	7	6	15	4.100
Paris	Dominion Natural Gas Co., Limited	2	0	2	0	2	.578
Toronto	Consumers Gas Co. of Toronto	23	1	0	0	24	16.0
Montreal, Que.	Montreal Light, Heat & Power Consolidated	8	0	0	0	8	5.344
Grand Total		27,667	47,123	6,340	18,398	83,817	27,522.327

[10] Includes 6289 radiant heaters.

[11] Gas company sales alone.

[12] Includes 77 radiant heater installations.

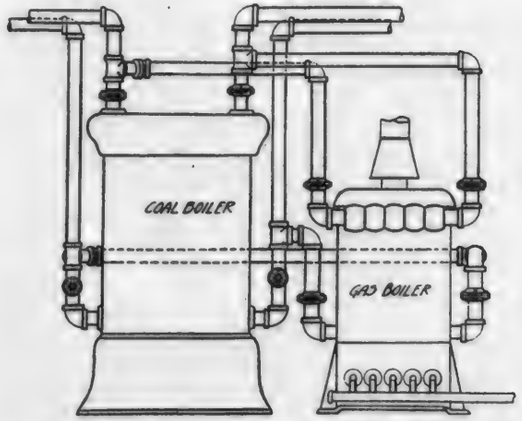
[13] Includes consumption of gas fires under heating rate.

This tabulation, prepared by the House Heating Committee of the American Gas Association, shows the status of gas house heating at the end of the last heating season. More than twenty-seven thousand millions of cubic feet of gas was burned during the heating season—an increase of more than five thousand millions of cubic feet.

CROSS CONNECTING GAS AND COAL-FIRED BOILERS

Quite frequently, when a customer already has a coal boiler in his home, it is desirable to leave it connected to the system, and cross-connect the gas boiler with it. For small gas companies or any others where there is any possible chance of a shortage or failure of gas, it would seem to be good practice to encourage cross connecting as the customer would realize very little for a second-hand coal boiler, and it is worth more to him as a safeguard against failure of his gas system than he would realize by selling it. It also produces a more secure feeling in the customer's mind when putting in gas-fired house-heating equipment, if he knows that he can burn coal at any time he has occasion to. He then feels that he is not at the mercy of the gas company if the rates should be changed. There is almost no difference in the cost of an installation, whether it is cross connected or displaced. Cross connection also gives the customer a means of disposing of papers, garbage, crating material, etc.

In hot water heating systems, it is necessary to valve-off the return pipes on the coal boiler to prevent circulation through the latter when the gas boiler is in use. Since the gas boiler holds comparatively little water and almost always is insulated, no valves are needed on the return pipes to the gas boiler. Hence, by opening the valves on the coal boiler, it may be operated independently or in conjunction with the gas boiler.



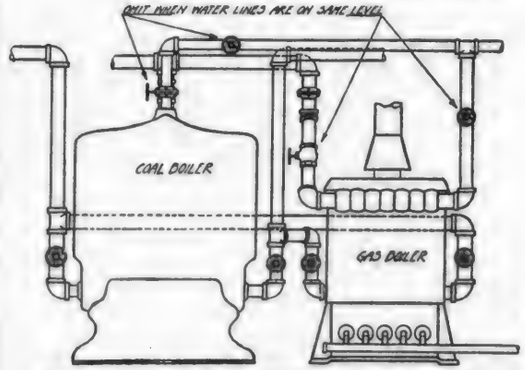
Cross Connecting Hot Water Boilers

From "House Heating," published by American Gas Association.

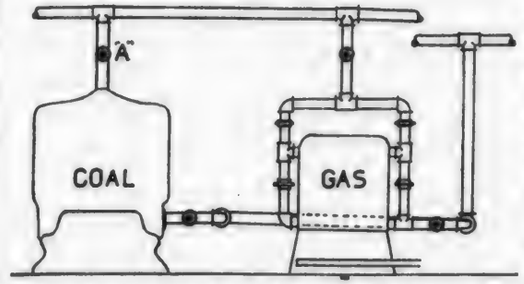
(*Continued on Data Sheet No. 50-G*)

CROSS CONNECTING GAS AND COAL-FIRED BOILERS

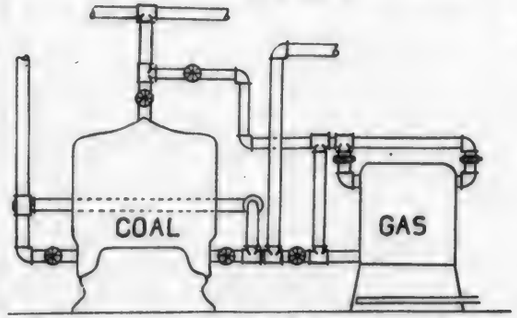
(*Continued from Data Sheet No. 50-F*)



Cross Connecting Steam Boilers, Water Lines Not on Same Level



Cross Connecting Steam Boilers with a Minimum Number of Valves. Valve A May Be Omitted as Indicated in the Text.

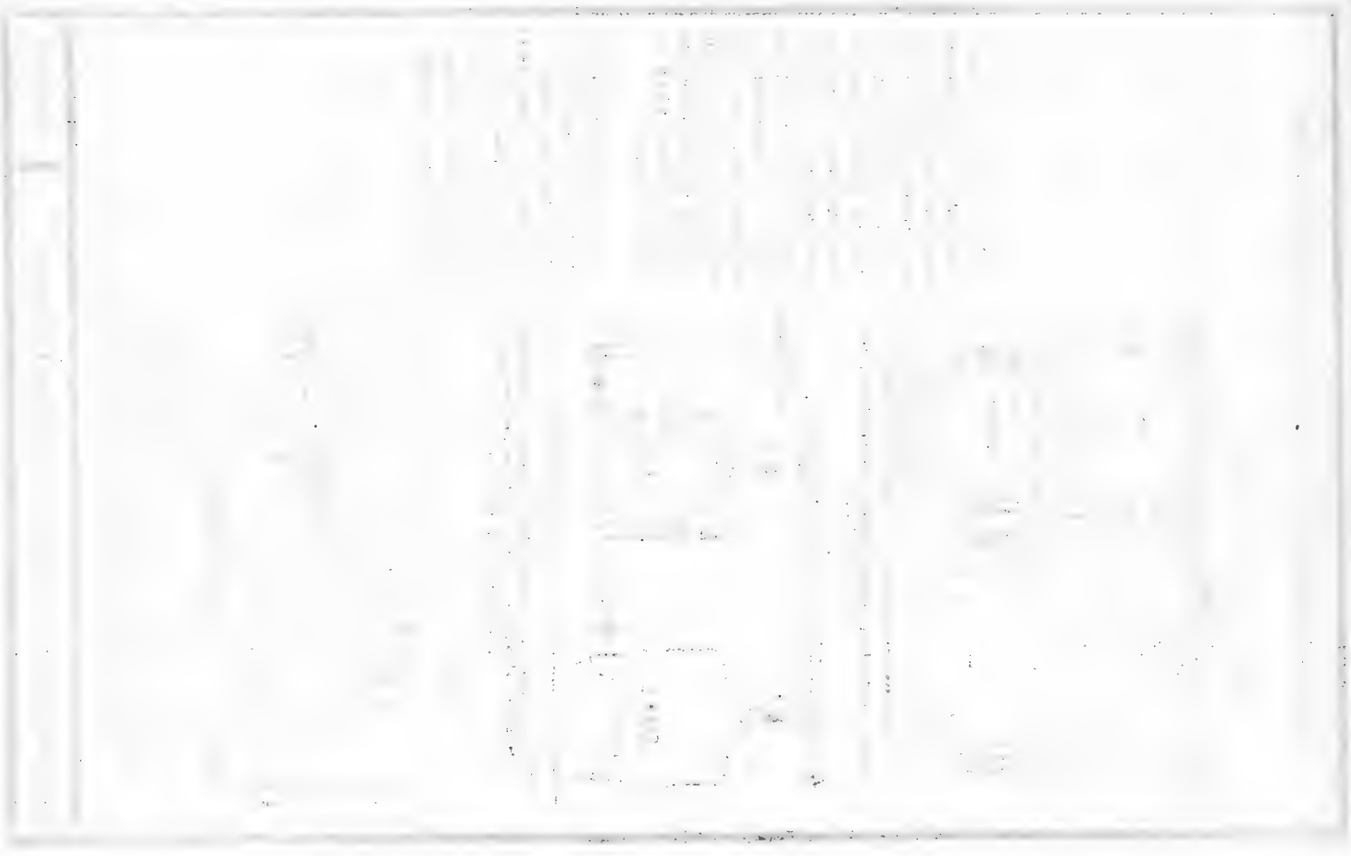


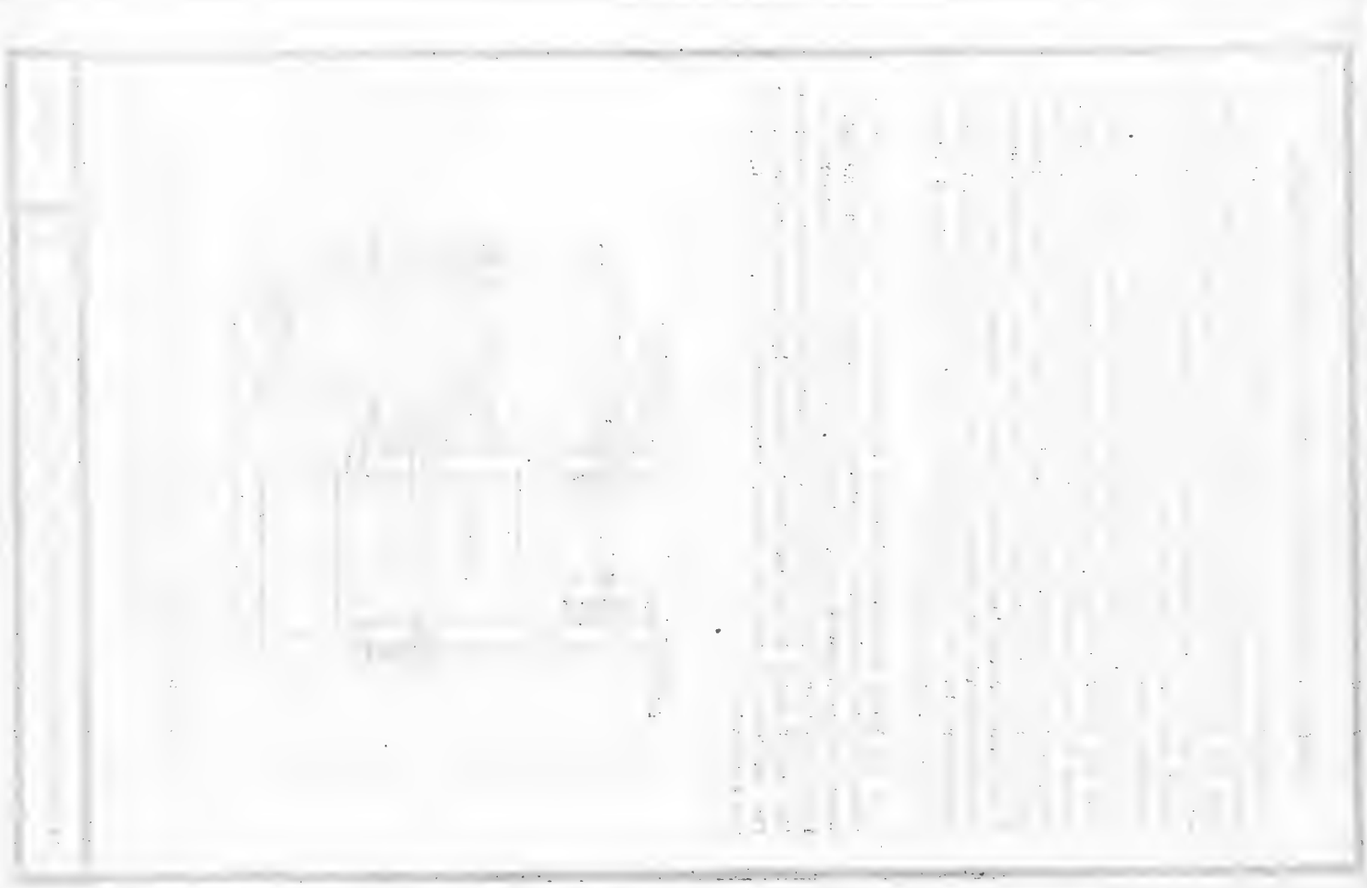
Cross Connection with End Drip for Steam Boilers

From "House Heating," published by American Gas Association.

For steam or vapor installation, it is necessary to valve-off all of the returns and flows on each boiler unless the gas boiler is set so that the water line in both boilers is at the same level, in which case it is necessary to valve-off only the coal boiler to prevent the heating of the water in the coal boiler when it is not in use.

The gas boiler should be set as close to the coal boiler as practicable, and the flows and returns should cut into the flows and returns of the coal boiler as near to the latter as possible.





How the Underwriters' Laboratories Looks at Domestic Oil-Burning Equipment*

By H. M. Robinson

Service Engineer, Underwriters' Laboratories

THE extent of Underwriters' Laboratories' contact with domestic oil-burning equipment has increased considerably during the past several years due to a growing realization, on the part of municipal and inspection authorities and the public in general, of the necessity of reducing to a minimum the fire hazard incident to its use. Although we became actively engaged in the testing of this type of equipment only as far back as 1918, in which year I believe that only two or three devices were tested, in 1928 approximately 500 individual burner tests were made and the total number of burners listed has been increased to over 100.

In the period between 1918 and 1925, Laboratories' engineers accumulated data from a considerable number of tests and records of field experience regarding the performance of different types and designs of burners and of their component parts, with a view toward the establishment of a standard which would properly govern construction and performance in such a manner as to minimize fire hazard and insure reliable operation over long periods of time. This compilation of data and review of field service records have recently been completed and have resulted in the development of a definite standard which is now consistent with present practice of the industry.

Experience in the testing of oil burners and a close follow-up of their performance in the field indicated that such a standard, in order to be practical and effective in securing acceptable design and proper performance, should basically govern three major characteristics of an automatic oil burner, which relate to safety; namely, safety of automatic operation, reliability of operation, and cleanliness. Underwriters' Laboratories' standard has been developed on the foundation of these three important characteristics.

With reference to "safety of automatic operation," the standard may be summarized somewhat as follows:

The safety control mechanism shall properly function to shut off the burner in the event of abnormal operation of any character before a considerable amount of oil has been discharged into the combustion chamber of the heating system or on the floor.

The design of the safety mechanism should be such as to render the burner inoperative in the event of failure of the mechanism itself and shall not lend itself to tampering by persons not familiar with its purpose.

The materials used in the construction of the safety control mechanism shall, whenever necessary, be capable of withstanding the effects of exposure to high temperatures and other corrosive agents.

In the case of burners designed for multiple installation in single heating plants the safety shut-off on each burner shall operate independently of the others if safe and reliable means are not provided as part of the burner assemblies for simultaneous or sequential ignition. This last requirement is essential in order to prevent one of two burners mounted in a single heating plant from discharging a considerable amount of oil into the combustion chamber after extinguishment of its flame, because the heat generated by the flame of the other burner causes the safety mechanism governing both burners to remain in "on" position.

Concerning "reliability of burner operation" the standard may be summarized somewhat as follows:

The arrangement of the burner assembly shall be such as to minimize the necessity and possibility of tampering by persons not familiar with the device, which would result in a condition of hazardous operation.

The ignition system shall be of a design which assures reliable and proper operation.

The burner assembly shall have sufficient rigidity to withstand external shock.

Rotating parts shall be enclosed to avoid the possibility of their injury by external objects.

The assembly of the burner shall

Installing a New Burner for Test

*Paper recently presented at the Kansas Fire Chiefs' convention, Liberal, Kan.

Checking Up on a Burner after a Long Run

be as simple as the principle of its operation permits, preferably in not more than two factory assembled and tested units, in order to minimize the possibility of faulty inter-connection of component parts by dealers or installation men who may not have been properly and thoroughly instructed by the manufacturer.

Regarding "cleanliness," the standard may be summarized somewhat as follows:

The burner assembly shall be properly safe-guarded against the possibility of oil leakage to the floor or excessive oil discharge in the combustion chamber.

The operation of the burner shall be such as not to result in the formation of hazardous carbon deposits in the combustion chamber of the heating plant or in the flues, thereby avoiding the secondary hazards which arise from such formations.

Scope of Laboratories' Oil-Burner Test Work

In order that you may have some idea of the scope of Underwriters' Laboratories' oil-burner test work and of the detailed manner in which each individual device is checked with the Standard, I have outlined several of the more common causes of serious oil-burner fires and will explain the manner in which we isolate and eliminate them, in so far as it is possible, in our regular investigation of a device.

A considerable percentage of oil-burner fires can undoubtedly be indirectly traced to the use of a lower grade of oil than the burner is designed to handle. The use of too low a grade of oil inevitably causes formation of hazardous carbon deposits which may render the safety mechanism inoperative or cause delayed ignition with consequent explosions of more or less major violence. At least part of the Laboratories' test of an oil burner is conducted with the lowest grade of oil which the manufacturer claims to be suitable. In many cases it has been determined that although a burner might properly handle an oil having a gravity of, for example, 28°, its operation with 20° or 24° oil would be hazardous. It is to be remembered that the Laboratories recommends the use of specific grades of oil which have been found to be suitable for individual devices.

Numerous fires have been directly attributed to the use of automobile crank case drainings. Such fuel usually contains a considerable amount of gasoline, a certain amount of the low ends of lubricating oil, grit, and sometimes small metal shavings. It is practically impossible to adjust the oil supply of a burner to handle both the high and low ends of such an oil. When such adjustment is set to take care of the low ends it is probable that the flame will get beyond control when the high ends, including the gasoline, are consumed. Underwriters' Laboratories has consistently recommended against the use of automobile crank case drainings as a fuel for domestic oil burners.

Oftentimes burners employing electric ignition and equipped with electric safety mechanisms are installed at the ends of overloaded power lines where the voltage, normally 110, has been actually reduced in some cases to 75. In such cases the danger of failure of the safety mechanism due to the reduced voltage is immediately apparent. Special tests are conducted by the Laboratories on oil burners of this type to determine whether the safety mechanism will function either to shut off the burner at 75 volts before ignition has failed or to properly shut it off at this voltage in the event of previous ignition failure. It is required that the safety mechanism have proper control of the burner at low voltages or function to shut it off when such voltages occur.

Problems Caused by Oil Characteristics

Change of viscosity of oil due to low atmospheric temperatures often results in failure of a burner to properly atomize the thickened oil, thus making failure of the device, by delayed ignition, possible. A special test is conducted on oil burners to determine whether they will properly atomize and ignite the grade of oil for which they are found to be suitable under normal temperature conditions at a temperature of 0° F. If such tests develop the fact that the burner is unable to handle the specified oil under these conditions it is required of the manufacturer that the atomizing and ignition systems be altered in such a manner as to insure the proper atomization and ignition of cold oil.

Inasmuch as it is also possible that a burner may be called upon to operate with cold oil when installed at the end of an overloaded power line with a voltage of 75 volts, an additional test is conducted at the Laboratories in which the burner must properly atomize and ignite the specified grade of oil at a temperature of 0° F. and under actual voltages of as low as 75 volts.

Probably one of the most common causes of oil-burner fires is the explosion of unburned oil vapor due to delayed ignition. In our test work the possibility of such an occurrence is minimized by careful examination and special tests of the ignition system and of the sequence of its operation in conjunction with the operation of the air and oil supply systems.

A burner which in its operation permits accumulation of oil on the floor or causes formation of excessive carbon deposits in the combustion chamber or flue introduces a number of secondary hazards which, in the aggregate, may result in considerable damage by fire. For example, carbon formation may cause momentary extinguishment of the flame, resulting in a puff-back of flame through the burner, which could ignite oil on the floor under the burner. In the intermittent operation of a burner.

the pilot light of which had failed, ignition of oil vapors which had been discharged in the few seconds before the safety mechanism operated could be caused by glowing carbon deposits in the combustion chamber or flues. In order to avoid failures of this character, intermittent and continuous operation tests are conducted for a period of several weeks to determine whether such oil accumulations and carbon deposits are possible.

The Spring Problem

The failure of a spring in the assembly of an oil burner might permit discharge of oil to the basement floor. In order to obviate such a possibility the Laboratories' standard requires that springs, when permitted, shall be designed to operate within a range of loading which will assure practically unlimited service and that they shall be suitably protected against abrasion and corrosion. The standard recommends against the use of springs, the failure of which will permit abnormal discharge of oil, and which do not give evidence of failure through the abnormal operation of the burner during the succeeding cycles of its operation.

It is undoubtedly true that many oil burner fires have occurred because it was possible for the householder to shunt out or defeat in another way the safety mechanism after it had properly operated to shut off a burner which was operating hazardously. Fires have occurred in this manner during periods of extreme cold when it was essential that heat be maintained. Special tests of safety mechanisms are made in order to obviate the possibility of operating a burner when the safety mechanism has been rendered ineffective. In this connection it is to be noted that, in so far as safety of a domestic oil burner is concerned, we are not so much concerned with the possibility of a householder freezing to death as we are with his burning to death.

In the foregoing I have mentioned only problems confronting the Laboratories' engineers in isolating and correcting construction features which unnecessarily contribute to fire hazard, and have not mentioned any of the numerous points which are of equal importance in so far as safe operation of a burner is concerned and which relate to the method of its installation. The Laboratories can go only one-half of the way in the elimination of unnecessary oil-burner hazards because we must of necessity stop with the burner itself. We do, however, require of the manufacturer that he supply installation and operating instructions which have been reviewed at the Laboratories and, if necessary, corrected to make them conform to the regulations of the National Board of Fire Underwriters governing the installation and use of domestic oil-burning equipments.

Proper regulation of oil-burner installation is as necessary as is the correction of undesirable features of design and construction, and such regulation is primarily the function of inspection and municipal departments. I am safe in saying that only a part of the avoidable hazards incident to the use of this type of heating equipment are traceable to the device itself, the other part being related to the manner of its installation. There is considerable truth in the old oil-burner proverb which says: "A good oil burner poorly installed can be more dangerous than a poor oil burner properly installed." Those fire departments, fire prevention bureaus and inspection authorities who depend on the Laboratories for information as to acceptable design of oil burners, to a large extent, will nullify our efforts in minimizing fire hazard if they fail to adopt and strictly enforce proper ordinances governing oil-burner installation.

It is perhaps unnecessary to outline in any considerable detail the various undesirable installation practices which contribute to the fire hazard of an oil burner and to which actual fire loss in the past has been traced. I will, however, briefly mention several of the more common substandard installation features which have resulted in fires in connection with properly designed burners.

If the main or auxiliary supply tanks are vented to the basement, oil vapors will increase the hazard in the event of a basement fire. Furthermore, if the tank is over-filled, excess oil will be discharged into the basement if vents are on the inside. All tanks should be vented to the outside of the building.

If the tank is installed under the basement floor and an opening is provided in it for measuring the oil level, excess oil may be discharged on the basement floor if the tank is over-filled. All openings for measuring oil level in the tank should be on the outside of the building. If the tank is installed under the basement floor a suitable oil level indicating device should be employed.

When any portion of the main supply tank is located above the level of the burner there is danger of siphoning the contents of the tank to the basement if the suction line to the burner is damaged by shock or if automatic oil valves do not close tightly. When tanks are installed in this manner a properly designed anti-siphon valve should be required in the suction line.

Aboveground storage tanks will discharge their total contents into the basement if oil supply lines connected to the bottom of the tank are broken. Supply and return lines to and from the burner should be connected to the top of the tank in all cases and where necessary equipped with suitable anti-siphon valves.

Supply and return lines should be constructed of full weight pipe and should be properly protected from external shock. It is desirable that all oil lines be installed in trenches or embedded in concrete.

Underground storage tanks should not be installed on a foundation of loose cinders. The corrosive action of sulphur usually present in cinders has been known to destroy tanks so mounted.

Considerable smoke and fire damage may result if the flue damper in the heating plant is accidentally closed. In order to avoid such a possibility it should be required that at least 20% of the area of the damper be cut away before the burner is installed.

In the event of an oil-burner fire it might be impossible to shut off the burner if a remote control is not provided in a room adjacent to the furnace room. Usually a switch opening the main line to the burner motor will provide easy means of shutting off the burner.

Smoke and possible fire damage may result from clogging of orifices in the burner by dirt in the oil. Suitable oil strainers, generally supplied by the burner manufacturer for use with his particular device, should be installed in the suction line between the supply tank and the burner.

Preventing Oil Leakage

The use of flanged unions provided with rubber gaskets will eventually result in leakage of oil to the basement floor. Rubber will in time become useless as a gasket when in contact with liquid fuel. Standard unions of the ground joint type should be used.

Considerable quantities of oil may be discharged to the basement floor upon breakage of glass gauges or sight feeds installed in the oil suction line. The use of glass gauges or sight feeds, the breakage of which will allow the discharge of fuel into the room, should be strictly prohibited.

So much for technical details concerning investigation of burners by Underwriters' Laboratories and regulation of their installation by inspection authorities. Obviously our original investigation and listing of a burner would be of little benefit to the industry and to regulatory bodies if it were not possible

to distinguish between listed and unlisted devices in the field. In order that you may understand the method and extent of the Laboratories' inspection program on current production of listed manufacturers I shall briefly summarize our inspection contact with the industry and outline the operation of the label service program.

Until January, 1928, domestic oil burners were listed under a re-examination service form of supervision and factory follow-up. Under this service labels were not attached to burners. The manufacturer was required to mark each device with a distinctive type or model number, different from the one used prior to listing and restricted to use on standard burners only. By reference to Underwriters' Laboratories' published re ords, burners could be identified in the field as of a listed type by this distinctive marking.

Detailed specifications governing design and construction of the listed burner were supplied the manufacturer; additional copies were retained by the Laboratories for the guidance of engineers in making examinations of current production. These examinations were made regularly but infrequently. If it were determined that alterations had been made in details or principle of the burner the manufacturer was required to immediately submit a new device for further test. If the new burner proved to be acceptable, listing was continued; if not, it was discontinued until the manufacturer had eliminated substandard features.

Label Service

In view of the substantial increase in the number of burners listed in 1926, and in the number of listed devices installed during and directly previous to that year, it was judged necessary to increase our inspection schedule, to control more closely the inspection manifest and to provide for more definite identification of listed burners in the field. After several industry conferences the present label service form of factory supervision was established in January, 1927.

Under this service listed manufacturers apply labels to standard burners as evidence of their inspection by Underwriters' Laboratories. Except in special cases it is not required that a distinctive type marking be provided. The application of the labels is closely controlled by Underwriters' Laboratories' agents and inspectors who thoroughly and frequently check design and construction of the product with definite specifications prepared by the Laboratories. Whereas under the re-examination service, examinations were made only at infrequent intervals, under the label service, inspections are conducted at intervals of from once a month to six times a month, depending upon the manufacturer's production of standard burners. If it is determined that the workmanship or assembly of any single burner is faulty, the label is removed from that device and canceled by our inspector.

Leading oil-burner manufacturers are closely cooperating with the Laboratories in the operation of the label service at their respective plants and are labeling a substantial percentage of their production of standard burners.

In conclusion I have one final point to make. Inspection and municipal authorities who look to Underwriters' Laboratories for information as to acceptable design of domestic oil burners should not depend on our published lists of inspected devices for evidence of compliance of a burner with the requirements. A so-called "approved" burner, implying listing by Underwriters' Laboratories, is not a labeled burner and has not been inspected and accepted by the Laboratories as a standard device unless it actually bears a label. A number of listed manufacturers produce burners of two or more designs only one of which may be eligible for labeling. Our published lists cannot indicate this fact. Furthermore, burners which have been rejected for labeling by our inspectors because of faulty workmanship, incomplete assembly, or for other reasons, may be shipped without labels by a listed manufacturer. In closing, then, let me repeat: a so-called labeled burner is not a labeled burner unless it bears a label. Look for the label as evidence of inspection by Underwriters' Laboratories.

Boiler Manufacturers Adopt New Testing Code

A NEW steam heating boiler testing code has been adopted by the National Boiler and Radiator Manufacturers' Association and has been issued as of January, 1929. The new code is a revision of a proposed heating boiler testing code prepared by the association's code committee last August. This preliminary code was sent to all of the association's members and to the manufacturers who were not members for comment and suggestion. As a result the association received a number of comments which were collated under the title of "Discussion of Comments on Preliminary Draft of Heating Boiler Testing Code," by a committee consisting of F. B. Howell, chairman; R. V. Frost, of the Frost Research Laboratory; T. E. Landvoigt, heating engineer of the National Radiator Corporation, and C. H. Flink, heating engineer of the American Radiator Corporation.

The code in its present form was formally adopted by the association at its annual meeting in New York, January 12. It provides for five tests to be conducted at 2 lbs. steam gauge pressure, one test to be at drive output and the other four at various output rates to show the entire operating range of the boiler. No test data of boiler information is to be assumed for an output beyond the drive test. The drive test shall be considered the boiler's maximum output. No tests are to be reported in which the water collected from the separator is greater than 25% of the water fed to the boiler in excess of the condensation resulting from the normal heat loss of the separator and piping.

With regard to the outlet piping the code specifies that the number and size of the outlets shall be as catalogued by the manufacturer. It is further provided that outlets shall be full size to a height of 30 in. above the boiler's normal water line. Each test is to be continued until there has been burned in pounds per square foot of grate not less than 250 in the continuous-fire method or 150 in the new-fire method, or until the error in fuel and water determination shall not exceed 2%.

Printed forms accompany the code including a boiler room log sheet for new-fire method and one for the continuous-fire method, together with one for use in making up a test report burning solid fuel.

A chart similar to that used by the H. & P.C.N.A. Boiler Output Committee for plotting boiler performance curves is a notable feature of the code.

Use of Briquets Has Increased Tremendously

Statistics from the Department of Commerce show an increasing use of fuel briquets in the domestic fuel market. In the twenty-year period from 1907 to 1927, the production increased from 66,524 tons to 970,468 tons, an increase of over 1400%. Production figures for 1927 show an increase of 15.6% over the 1925 figures, indicating that the use of this type of fuel steadily is increasing.

U. S. Bureau of Mines Surveys 1927 Fuel Oil Distribution

DELIVERIES of gas oil and fuel oil in 1927, reached a total of 381,151,000 barrels, including exports and shipments to non-contiguous territories, as compared with 372,381,000 barrels in 1926, according to figures recently made available by the United States Bureau of Mines, in a book'et, "National Survey of Fuel Oil Distribution, 1927," compiled in cooperation with the American Petroleum Institute. Quantities delivered in the United States, showed a slight decrease from 334,030,000 barrels in 1926, to 333,760,000 barrels in 1927.

Decrease in oil used in 1927 (Fig. 1) was shown by railroads, general manufacturing, gas and electric companies, oil companies (as fuel), smelters, mines, foundries and steel mills. The use of fuel oil on steamships increased from 79,288,000 barrels, in 1926, to 88,215,000 barrels in 1927. Exports increased, as did the use of oil by the Navy, transports, etc. Gas and fuel oil for heating buildings rose, in 1927, to 21,521,000 barrels, from 16,779,000 barrels in 1926.

Domestic heating in 1927 called for 6,377,479 barrels as against 2,905,401 barrels in 1926. These figures do not include furnace oil and distillates delivered for domestic heating, which are estimated at 6,000,000 barrels (2,000,000 barrels on the Atlantic coast and 4,000,000 barrels in the Central States), in each of the last two years. This would bring the total amount of heating oil for all buildings up to 27,520,000 barrels

TABLE 1

Gas and Fuel Oil Deliveries for Heating Buildings

(Barrels of 42 Gal. each)

	Commercial Heating		Domestic Heating	
District	*1926*	*1927*	*1926*	*1927*
Pacific Coast States	3,919,275	4,326,539	40,163	83,635
Rocky Mountain States	14,319	44,413	12,791	25,509
North Central States	1,348,270	2,063,976	1,168,538	2,941,748
South Central States	1,929,682	1,177,859	357,592	1,020,817
New England States	2,838,387	2,932,259	312,138	669,567
Middle Atlantic States	3,711,930	4,501,257	1,011,083	1,599,643
South Atlantic States	112,318	96,942	3,096	36,560
Totals	13,874,181	15,143,245	2,905,401	6,377,479

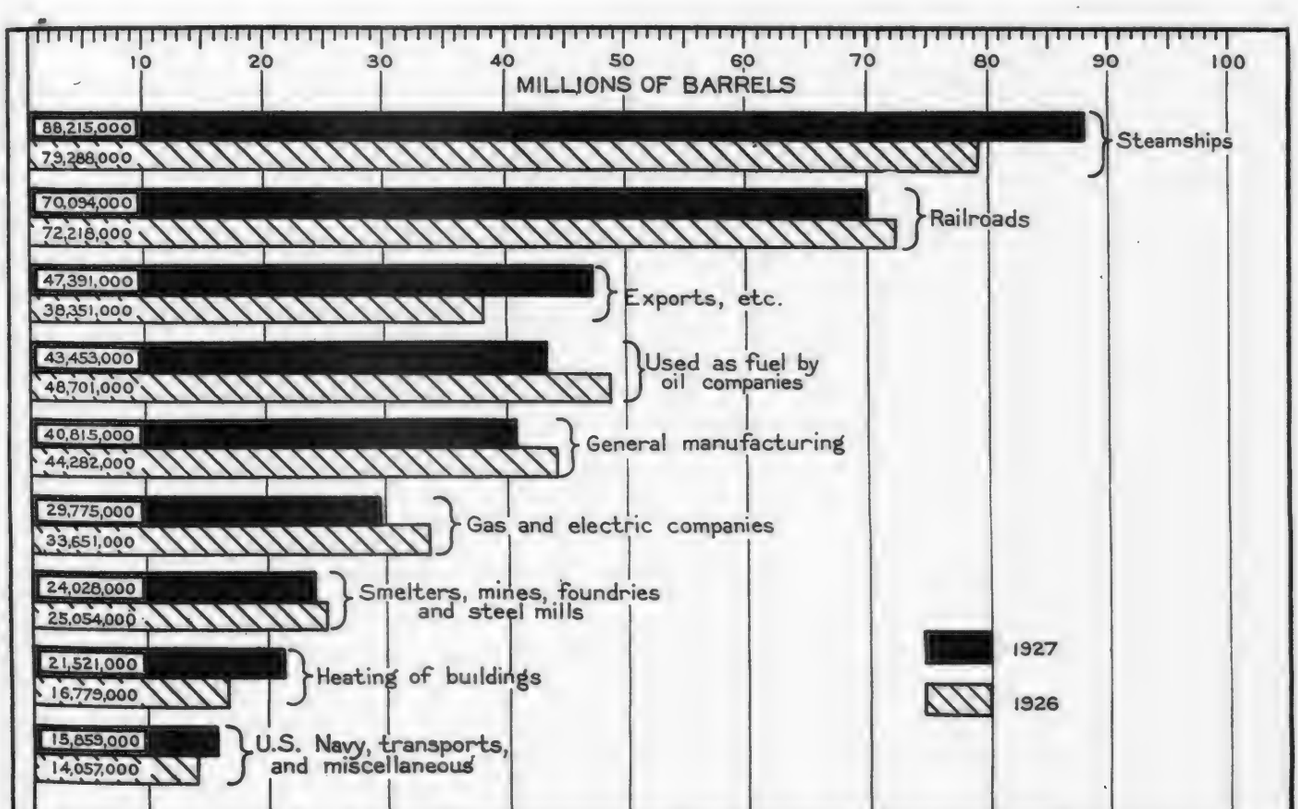


Fig. 1. Gas Oil and Fuel Oil Deliveries, 1926-27

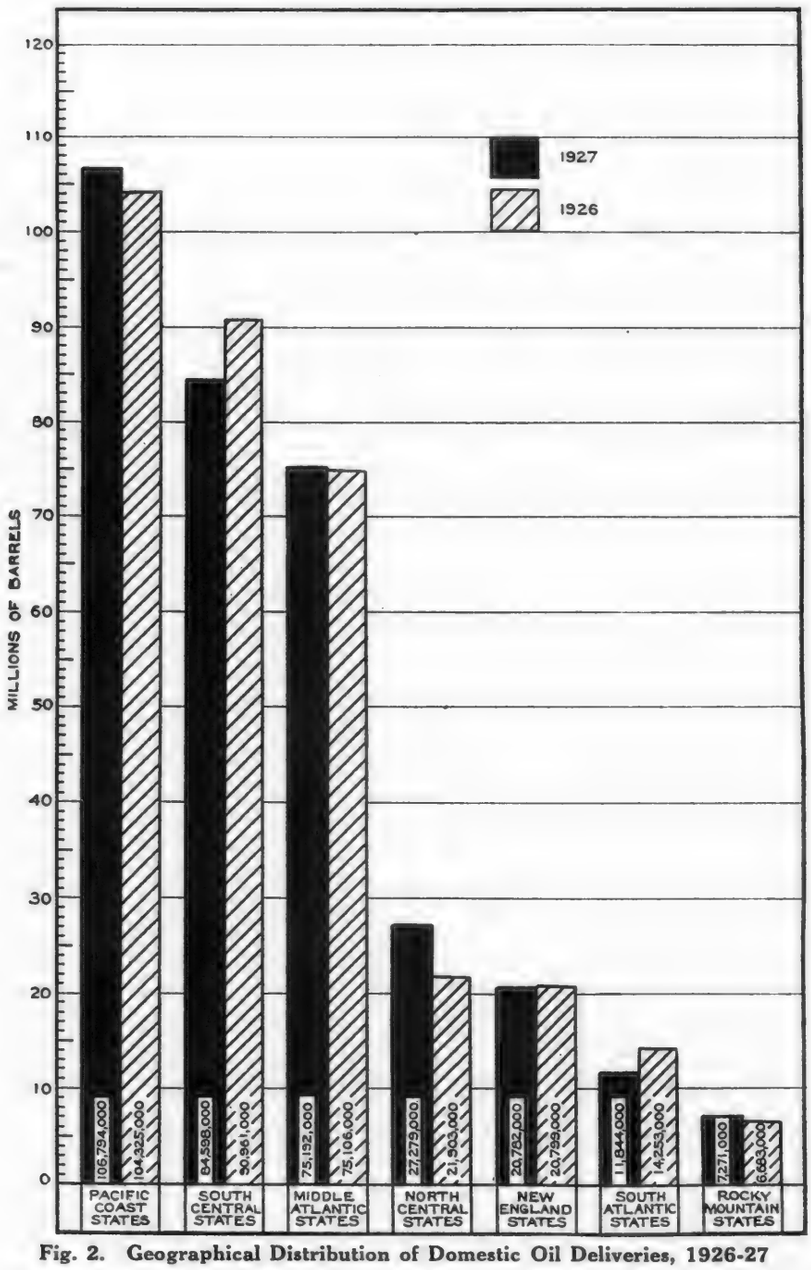


Fig. 2. Geographical Distribution of Domestic Oil Deliveries, 1926-27

TABLE 2

Uses	*1926*	*1927*
Railroads	72,217,652	70,094,416
Bunker oil, including tankers	79,287,605	88,215,028
Gas and electric power plants	33,651,513	29,774,772
Smelters and mines	8,951,817	6,831,275
Iron and steel products	16,102,458	17,196,778
Chemicals and allied industries*	.....	2,189,949
Automotive industries	1,603,393	1,686,605
Textiles and their products*	.....	4,620,626
Paper and wood pulp*	.....	3,130,603
Logging and lumbering	3,183,597	2,370,449
Cement and lime plants	5,586,144	5,051,051
Ceramic industries	3,216,850	3,270,036
Food industries	7,674,766	7,143,203
Other manufacturing*	23,017,235	11,352,558
Commercial heating	13,874,181	15,143,245
Domestic heating	2,905,401	6,377,479
U. S. Navy, transports, etc.	6,541,638	6,505,869
Used as fuel by oil companies	48,701,023	43,452,584
Miscellaneous uses	7,514,599	9,353,488
	334,029,872	333,760,014

*Deliveries to chemical and allied industries, textiles and their products, and paper and wood pulp were included under "Other manufacturing" in the 1926 survey. Sugar refineries are included with "Food industries" in the 1927 survey.

during 1927, as compared with 22,780,000 barrels in 1926.

Table 1 gives the amount of fuel oil and gas oil delivered for commercial and domestic heating to the various districts of the United States during the last two years. This does not include furnace oil and distillates.

It will be noticed that every district showed an increase in the amount of oil delivered for heating during 1927 over 1926, except the South Central States and the South Atlantic States. This is accredited to the increased use of natural gas. There is a constant increase in the use of heavy oils for domestic heating in all districts, ranging up to nearly three times the amount in 1927 that was used in 1926. This seems to be indicative of the trend toward gas oil and fuel oil for domestic heating, with commercial heating making only a slow, steady gain from year to year. Heating, however, is only a small item in the use of fuel oil.

Gas House-Heating Grows

An increase for 1928 of house-heating installations made by a representative number of gas companies, is shown as 16% over 1927. According to the American Gas Association, the number of companies reporting these installations during the past year was 228.

The association's house-heating committee emphasizes the fact that the revenue derived from the heating business is substantial, amounting to $22,176,000, assuming an average price of 80 cents per thousand cubic feet of gas. This figure, while imposing, is far short of the actual revenue obtained from this kind of business, the committee says, for it does not include more than half of the revenue obtained by companies operating in natural gas territory.

One interesting disclosure shows that the manufactured gas company reporting the greatest number of heating installations per thousand meters, has sold only 1.6% of its customers.

International Heater News, Vol. I, No. 1, has been received from the International Heater Co., Utica, N. Y. Published primarily for heating contractors and dealers in International products, the new paper contains information concerning advertising and sales helps. Among the former is a series of advertising cartoons featuring the activities of the Cold Family Robinson, mats for these being furnished to the dealer without charge. The paper is well illustrated and also contains a description of an interesting installation of International boilers in the Victory Plant at Squantum, Mass. The publication, which is available to dealers, will be published monthly.

Present Practice in Water Heating

Thrush System

THE Thrush system of water heating is a closed system with circulation under pressure and automatic control of dampers by a thermostat. It comprises equipment which may be added to any type or make of gravity water heating plant to convert it into such a closed or pressure system.

Included in the devices required for such a conversion are the Thrush differential-pressure relief valve for the relief of all excessive pressures, an air-tight pressure tank, automatic temperature damper regulator, damper equalizers, thermometer and special gauge. This equipment is obtainable as a complete unit.

The pressure tank is placed close to the boiler, which contributes to the ease of installation and eliminates danger of freezing. It is installed at any point where air is apt to accumulate, being usually tapped into the flow risers just above the boiler. This keeps the air from getting into the radiators and leads it into the tank where it is useful in cushioning the pressure on the system.

The tank is closed to the atmosphere but, in spite of the fact that it is air tight, it serves as an expansion tank because the air which is always maintained in the top of the tank can be compressed to accommodate expansion of the water except when excessive pressures accumulate. Then the pressure-relief valve permits a portion of the water to overflow until the pressure again is normal.

Tests Determine Advantage of Use of Pressure

To determine the advantages of the use of pressure to increase circulation in the system, Thrush engineers made a series of tests which has settled the point conclusively.

The plant used in the test was properly equipped with temperature and pressure indicators so that frequent readings could be made. Fuel was carefully weighed and at the beginning and end of each test the ash and unburned fuel was checked back so that the actual fuel consumed could be ascertained. Tests were conducted at night in order that outside temperature conditions might be as uniform as possible.

In the test here referred to, an added pressure of 15 lbs. was carried above the normal static of the system as a gravity job. The result showed 18.8% higher B.T.U. delivered to the building with 22% less consumption of fuel, or a total of 40.8% higher efficiency in favor of the pressure system. It also was found that the stack temperature was much lower in the pressure system. Therefore, it was concluded that pressure increases the rate of heat transmission, causes faster circulation and reduces fuel consumption.

Operation of Differential-Pressure Relief Valve

In the operation of the Thrush differential-pressure relief valve, which is used to accomplish this increased efficiency, a tremendous pressure is built up, tending to open the valve much more than would be accomplished by the pressure actually in the system. Fig. 4 shows this valve. A by-pass from the seat, or the closed side, of the valve leads to the head, the area of which is about ten times that of the seat. Twenty-five pounds per square-inch pressure in the system means 25

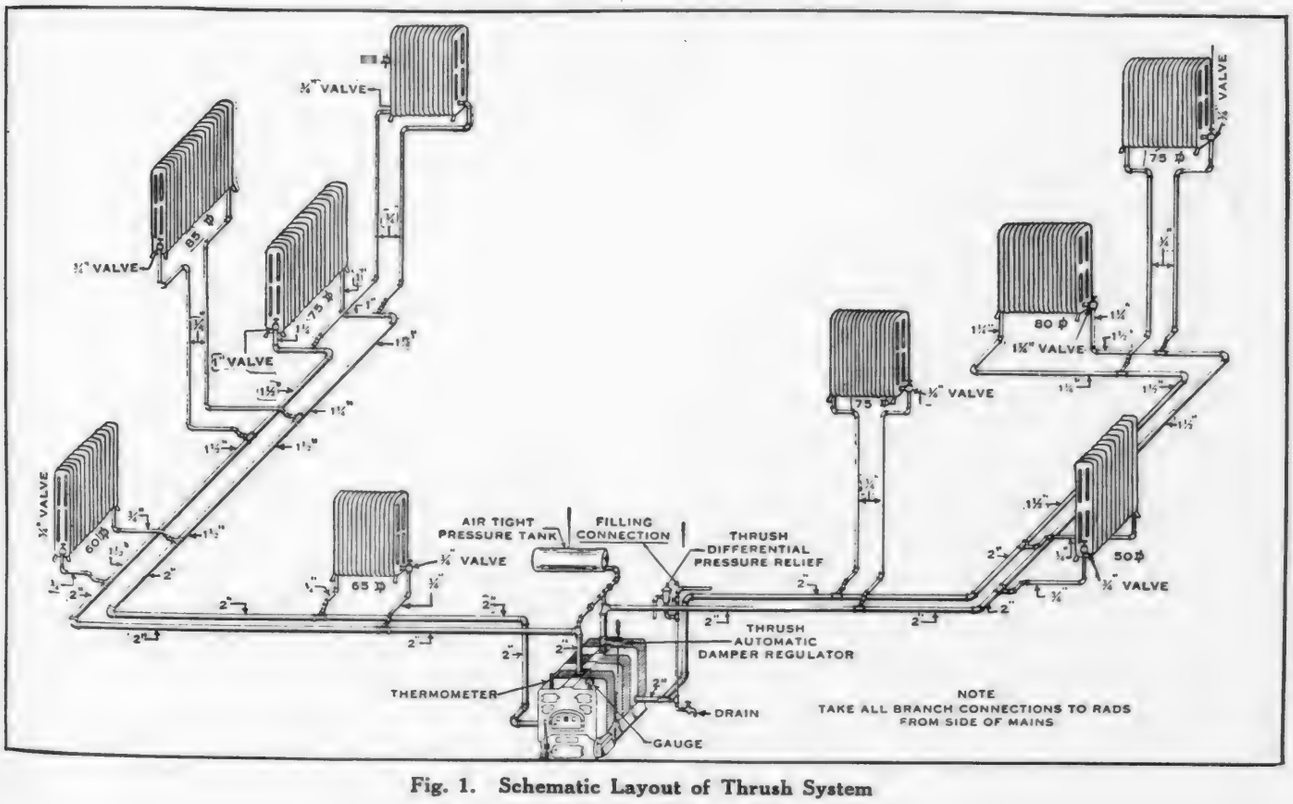


Fig. 1. Schematic Layout of Thrush System

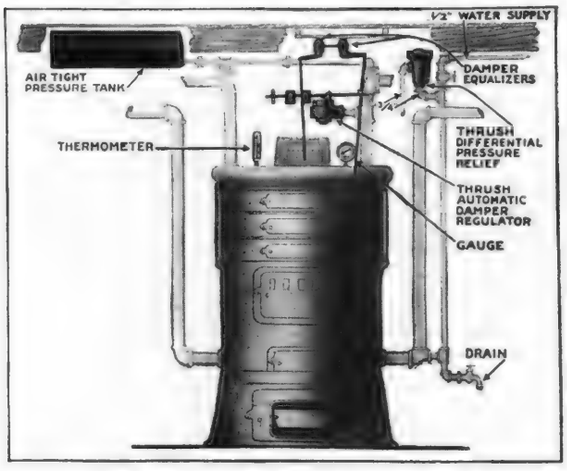


Fig. 2. One Method of Connecting Damper Regulator

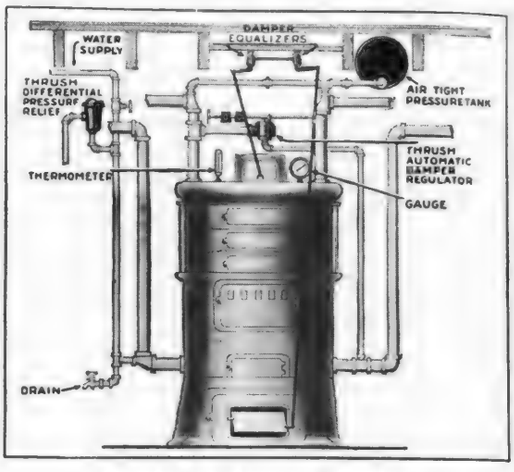


Fig. 3. An Alternate Hook-up of Damper Regulator

lbs. pressure on the seat, since it is just 1 sq. in. in area, but it means 250 lbs. of pressure exerted on the head pushing downward to open the valve.

Every additional pound of pressure in the system gives approximately 10 additional pounds of pressure on the head. The differential between the pressure on the seat and the pressure on the head provides the safety factor that gives the name to the valve.

An interesting feature of this valve is that it seats upward. It is always submerged in water so that there is no danger line where air and water meet. This arrangement also has the advantage of permitting dirt and sediment to fall away from the valve seat.

Damper Control

Control of the dampers is obtained by connecting the automatic damper control with a 1½-in. close nipple, as shown in Fig. 2, or it may be connected circulating back to the return part of the boiler, as shown in Fig. 3. The regulator is slightly higher in efficiency when connected to the return port but will work satisfactorily either way. Six separate thermostat units are included in the control and a defect in one does not put the regulator out of service. They are set in a dry well surrounded by the hot water leaving the boiler.

The operation of the thermostat depends upon the temperature of the hot water circulating through the heating system and is not in any way affected by pressure changes. An adjustment of the weights on the lever changes the temperature at which the dampers will close or open.

Four sizes of the Thrush system are furnished to accommodate radiation from 350 sq. ft. up to 2000 sq. ft. and by adding an additional pressure tank, additional radiation may be cared for.

The system also is offered as "Class A" and "Class B" equipment. Class A equipment includes the complete system, whereas Class B equipment includes only the air-tight pressure tank, differential-pressure relief, thermometer and gauge. This is offered for those cases where temperature regulation is not required, as in the case of an oil burner where a regulator is already provided, and yet where it is desired to provide increased heating efficiency.

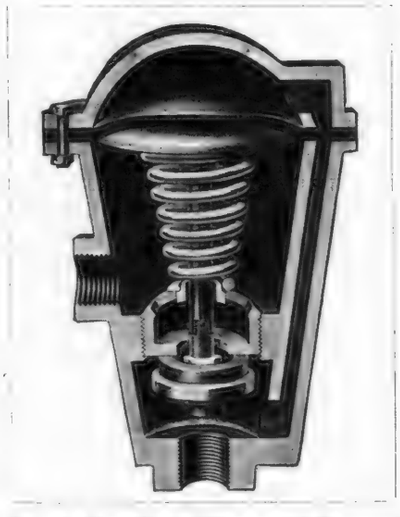


Fig. 4. Details of Differential Pressure

The system is adaptable to sectional boilers or any type of hot water installation, including Arcola or overhead piping systems.

Effective Business Letters

The joint work of Edward Hall Gardner, professor of business administration and his assistant, Prof. Robert Ray Aurner, of the University of Wisconsin, a volume dealing with the art of writing business letters, is issued by The Ronald Press Company, New York. Many of the twenty-three chapters contain information of value to readers of THE HEATING AND VENTILATING MAGAZINE, including those on Credit Letters, Collection Letters, The Collection Follow-Up, Sales Letters, and, in particular, a chapter on "Selling a Service to the Consumer by Direct Mail." The volume contains 384 pages, is priced at $3, and can be obtained through the book department of THE HEATING AND VENTILATING MAGAZINE.

Air Conditioning in the Flour Industry

The latest issue of *The Weather Vein*, published by the Carrier Engineering Corp., Newark, N. J., is a treatise on flour making with special reference to the atmospheric conditions to be maintained in the flour mill for best results. As stated in the text:

"The whole scheme of flour milling is a gradual, controlled reduction of the whole grain by means which separate the bran or outer coat of the berry and also remove the germ or seed within it, leaving one stream of flour which is almost wholly free of bran and entirely free of germ, being composed of the inner food cell of the wheat, together with other separate streams which are not quite so pure.

"The wheat berry is a fruit, not a seed, the seed being a germ contained within the berry."

In his inimitable style Esten Bolling tells the story of the various mechanical and other processes that have, as he says, "developed a process for the reduction of the crude berry itself that rivals, in intricacy and ingenuity, that other basic accomplishment of civilized man, the manufacture of cloth from the fibres of the cotton plant."

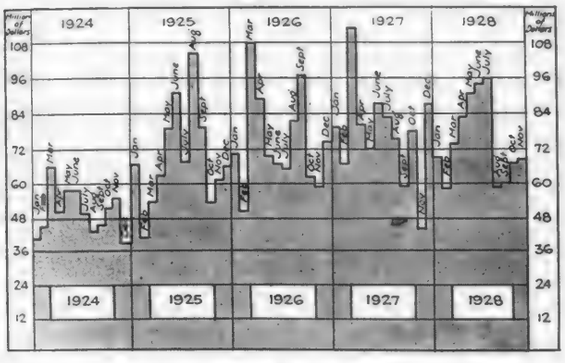
The little volume is exceptionally well illustrated with drawings and photographs.

Comprehensive Survey Indicates Continued Building Activity in 1929

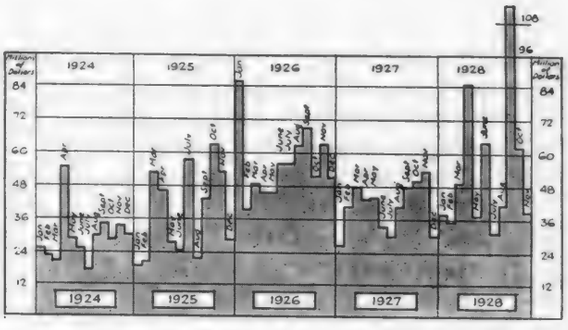
THAT the year just opening will find building activities exceeding all past records, is evidenced by a report just completed by the National Building Publications of National Trade Journals, Inc., of which THE HEATING AND VENTILATING MAGAZINE is one.

This survey probably is the most detailed and exhaustive study of potential building activity ever made in this country. For the past seven years the *Architectural Forum*, the leading professional journal in the architectural field, has presented an exhaustive study of the work under way in the architectural offices of the country for the ensuing year. The predictions which have been based on this annual survey have proved to be unusually accurate by the ultimate contract figures later developed.

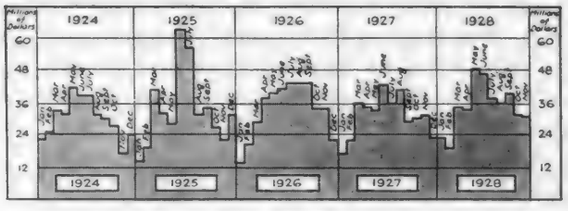
This last survey afforded additional opportunity, in comprehensiveness and accuracy, because of the bringing together of these magazines with their nation-wide organizations. The present forecast is based upon confidential individual reports from the offices of 2057 architects throughout the country, covering in detail the work now on their boards or in definite contemplation for contract-letting in 1929, plus the information derived through the general building field as covered by the other magazines. The total contacts include more than 150,000 individuals in organizations who are directly interested in various phases of the building industry and a cross section of whose opinions must have a great bearing upon future activities. The accompanying tabulation shows in detail the amount of work esti-



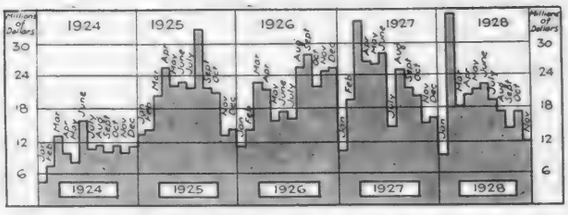
Commercial Buildings



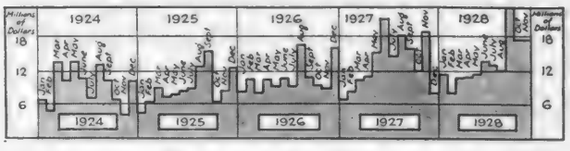
Industrial Buildings



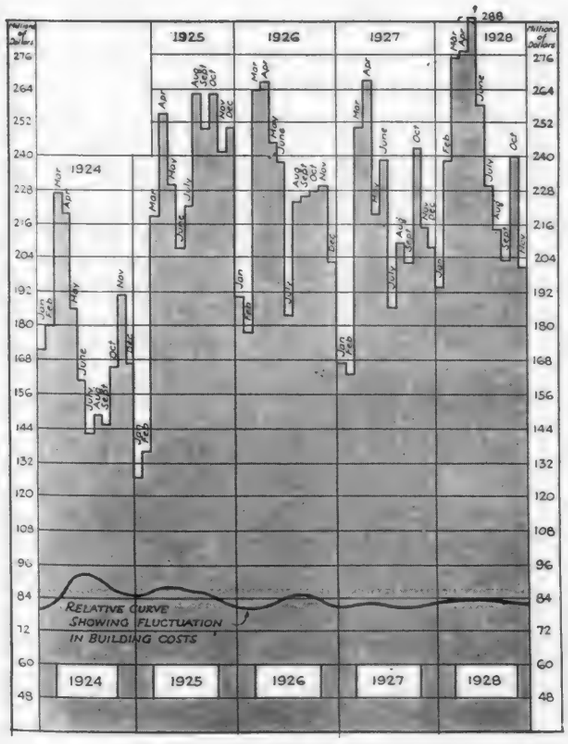
School and College Buildings



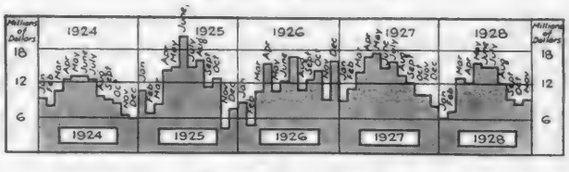
Club and Fraternal Buildings



Hospitals and Institutions



Residential Buildings



Church Buildings

Charts Showing Value of New Construction for Past Five Years

BUILDING TYPES	N. EASTERN STATES	N. ATLANTIC STATES	S. EASTERN STATES	S. WESTERN STATES	MIDDLE STATES	WESTERN STATES	U. S. A.
Automotive	$14,469,400	$42,132,200	$7,447,000	$10,670,000	$56,322,200	$14,539,800	$145,580,600
Banks	15,730,000	53,312,600	1,148,400	5,984,000	56,999,800	12,859,000	146,033,800
Apartments	16,801,400	366,163,600	10,469,800	20,882,400	171,941,000	84,992,600	671,250,800
Apartment Hotels	2,640,000	83,560,400	4,972,000	15,554,000	97,979,200	41,925,400	246,631,000
Club, Fraternal, etc.	7,231,400	70,010,600	1,515,800	13,191,200	66,704,000	15,987,400	174,640,400
Community and Memorial	3,421,000	21,232,200	1,529,000	5,711,200	17,047,800	11,710,600	60,651,800
Churches	21,142,000	55,105,600	22,770,000	23,859,000	69,885,200	20,409,400	213,171,200
Dwellings (Below $20,000)	10,936,200	83,540,600	6,791,400	11,215,600	40,198,400	24,314,400	176,996,600
Dwellings ($20,000 to $50,000)	10,346,600	38,445,000	5,935,600	7,629,600	37,470,400	15,085,400	114,912,600
Dwellings (Over $50,000)	6,749,600	43,443,400	5,555,000	5,662,800	25,348,400	12,837,000	99,596,200
Hotels	21,659,000	95,763,800	14,212,000	45,513,600	101,378,200	66,149,600	344,676,200
Hospitals	18,860,600	110,105,600	4,606,800	12,749,000	73,035,600	33,169,400	252,527,000
Industrial	20,295,000	130,191,600	15,661,800	35,846,800	154,671,000	28,789,200	385,455,400
Office Buildings	12,485,000	244,101,000	4,859,800	41,296,200	300,979,800	87,760,200	691,482,000
Public Buildings	15,518,800	185,924,200	6,226,000	18,499,800	87,353,200	27,689,200	341,211,200
Schools	44,811,800	165,499,400	13,010,800	60,152,400	256,326,400	57,981,000	597,781,800
Stores	6,366,800	78,876,600	4,477,000	7,926,600	55,497,200	23,324,400	176,468,600
Theaters (All Types)	6,303,000	62,891,400	3,746,600	7,812,200	74,032,200	8,773,600	163,559,000
Welfare Y. M. C. A., etc.	10,799,800	48,100,800	5,077,600	13,666,400	31,858,200	4,644,200	114,147,000
TOTAL VALUE OF NEW BUILDINGS	$266,567,400	$1,978,400,600	$140,012,400	$363,822,800	$1,775,028,200	$592,941,800	$5,116,773,200

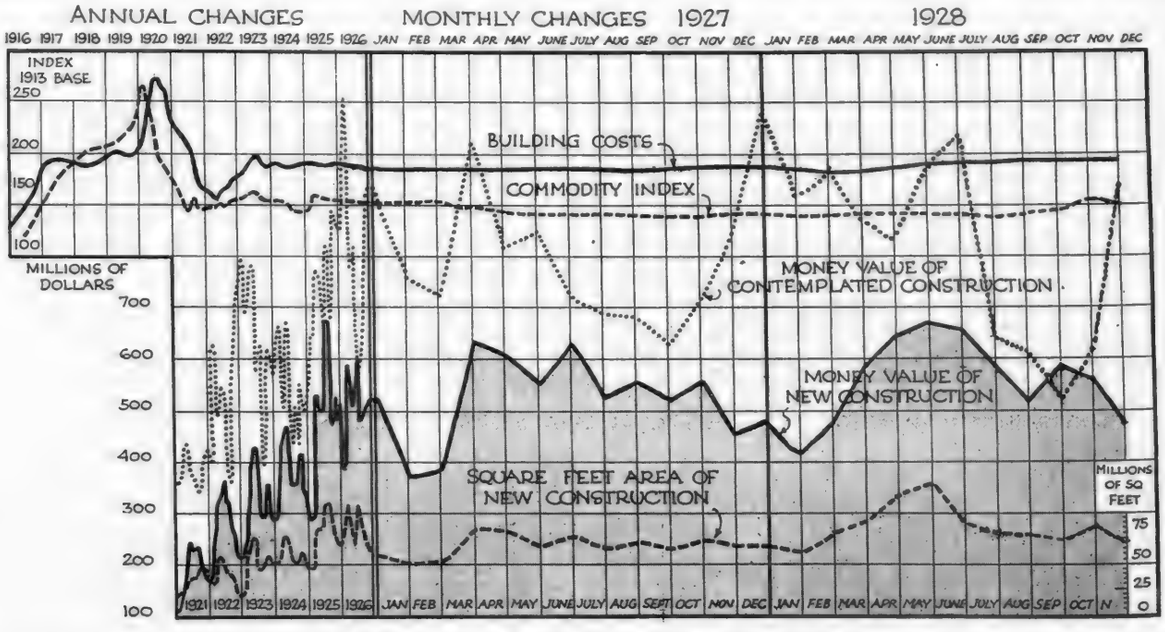
New Construction Under Architect's Supervision	$5,116,773,200
Buildings of All Types—Excluding Public Works and Utilities—Not Designed by Architects (Estimated from Averages of Previous Years)	2,192,020,000
TOTAL ESTIMATED CONSTRUCTION FOR 1929 (Exclusive of Public Works and Utilities)	$7,308,793,200

Detailed Forecast of New Building Construction for 1929

mated to be on the boards of architects for building in the year 1929. This work does not include public works and utilities, but covers only actual building construction as contemplated by various types of owners who make up the clientele of the architectural profession today. Added to this there have been developed figures covering the types of buildings which are not planned by architects but which in large measure are developed by contractors, engineers, and speculative builders, as detailed in the table.

Thus we find that the first significant fact is the unusual amount of prospective construction reported by the architects of the country. There may be found in evidence the consummation of a number of vast development projects and improvements which are opening up tremendous territories for active building construction. The subdivision builders of the residential field are undertaking housing projects almost beyond imagination in their scope. There is under way the most extensive modernizing and remodeling program ever known in the history of this country. This program is being deliberately developed by extensive educational work through building material manufacturers who realize the tremendous size of the potential markets created.

Coupled with all these factors we have an increasing urge toward building con-


ANNUAL CHANGES
MONTHLY CHANGES 1927
1928
1916 1917 1918 1919 1920 1921 1922 1923 1924 1925 1926 JAN FEB MAR APR MAY JUNE JULY AUG SEP OCT NOV DEC JAN FEB MAR APR MAY JUNE JULY AUG SEP OCT NOV DEC
INDEX 1913 BASE
250
200
150
100
BUILDING COSTS
COMMODITY INDEX
MILLIONS OF DOLLARS
700
600
500
400
300
200
100
MONEY VALUE OF CONTEMPLATED CONSTRUCTION
MONEY VALUE OF NEW CONSTRUCTION
SQUARE FEET AREA OF NEW CONSTRUCTION
MILLIONS OF SQ FEET
75
50
25
0
1921 1922 1923 1924 1925 1926 JAN FEB MAR APR MAY JUNE JULY AUG SEPT OCT NOV DEC JAN FEB MAR APR MAY JUNE JULY AUG SEP OCT N

Building Activity in the United States Since 1916

The various index lines are designated on the chart, which is developed from reports of the United States Department of Commerce, the F. W. Dodge Corporation, and The Engineering News-Record

888 Feet Long
U. S. S. SARATOGA
Largest ship ever to go through the Panama Canal

U. S. S. LEXINGTON
Being eased into dry dock by aid of 15 tugs

THE POWERS HYGROSTAT
for Humidity Control

Largest and Fastest Airplane Carriers Equipped with POWERS HYGROSTATS

Each of the 106 Sturtevant Unit Heaters installed in the ships shown above is equipped with a Powers Hygrostat and Diaphragm Valve.

Because of their Accuracy and Dependability, Powers Hygrostats have been used for years on Air Conditioning Apparatus installed in schools, theatres, hotels, textile mills and on numerous industrial processes in the most prominent firms of America.

THE POWERS REGULATOR COMPANY

35 Years of Specialization in Temperature Control
CHICAGO: 2718 Greenview Ave. NEW YORK CITY: 137 E. 46th St.
Offices in 35 Other Cities
The Canadian Powers Regulator Company, Toronto, Ontario

POWERS

struction by the public whose pocketbook was never so fat. We have a national administration which is known to have a constructive attitude toward developments which involve building and in which there is definite confidence on the part of all elements of the business world. We face several years of obvious prosperity and with no dark clouds threatening any disturbance of a program which promises more comfortable and efficient housing for all types of commercial, industrial and domestic activities.

Significant Changes in Building Trends

While every condition points to a continuation of building activity and perhaps the exceeding of all past records to the amount of 4% or 5% for the year 1929, there are some significant changes. To measure the change in public demand by comparing the percentage figures of the 1928 forecast with those of the 1929 forecast, the following data are developed:

In the field of dwelling construction the reports show less work on the boards of architects at the present time, but two facts must be realized in this connection. First, that a large proportion of projects of this nature were not actually on the boards in December, when this survey was made, and, second, in the field of small dwellings a very large proportion of houses costing less than $15,000 are not designed by architects. It would seem in this field that there would be built approximately the same volume of residential construction in 1929 as in 1928—perhaps more, and that in the case of houses costing $50,000 next year will equal, if not exceed, the records of 1928.

Type of Building	Requirements for New Buildings by Percentages			
	1928	1929	Charge	
Automotive	3.9	2.8	—1.1	About 1/3 less
Banks	2.8	2.9	+0.1	Slightly more
Apartments	13.2	13.1	—0.1	About the same
Apartment hotels	4.4	4.8	+0.4	About 1/10 more
Clubs, fraternals, etc.	3.5	3.4	—0.1	About the same
Community, memorial	1.5	1.2	—0.3	About 1/5 less
Churches	4.3	4.2	—0.1	About the same
Hotels	6.9	6.7	—0.2	About the same
Hospitals	6.2	4.9	—1.3	About 1/5 less
Industrial	5.3	7.5	+2.2	About 40% more
Office buildings	11.8	13.5	+1.7	About 15% more
Public buildings	6.7	6.7	—	About the same
Schools	11.5	11.7	+0.2	Slight increase
Stores	2.9	3.4	+0.5	About 20% more
Theatres	3.3	3.2	—0.1	About the same
Welfare, Y. M. C. A., etc.	2.1	2.2	+0.1	About the same

This Billboard Erected in Front of a Chicago Apartment Building Indicates the Large Number of Industries Involved in Its Construction and Shows that the Heating, Refrigeration and Ventilation Is Handled by a Heating Contractor, While the Plumbing Is the Work of a Separate Organization.

New Boiler Rating Charts

The Heating and Piping Contractors National Association has issued a revision of its cast-iron square boiler charts, Part II of Engineering Standards, and supplanting the cast-iron square boiler charts issued July 1928. The revision consists of rules for computing net boiler loads for equivalent cast-iron column radiation and the tabulated data for use therewith.

H. & P. C. Committee on Welding

The subcommittee on welding of the Heating & Piping Contractors National Association met at national headquarters in New York City, January 10 and 11. The committee consists of John H. Zink, Baltimore, Md., J. A. McLeod, New York, and H. E. Wetzell, Cleveland. It is the immediate intention of the committee to collect information on welding and make it available to contractors, architects and engineers. The program calls for the development of methods for training operators, the standardization of methods and materials for welding and the writing of a uniform specification for welding.

The committee is extremely alive to the importance of welding as a factor in the heating industry and proposes, at the earliest possible moment, to develop sufficient workers, so that heating contractors with welding work will not lack for competent artisans. It also is appreciative of the fact that much of the early work in this line was done with materials not well adapted to the purpose, and in some cases, designed specifically for threaded connections. This resulted in uncouth work and uneconomical procedure. The committee now is working with manufacturers of materials to develop satisfactory designs for welding work. The first project taken up is a flange for welding and this now is being designed in such a manner that it can be used with only one weld. Standardization of equipment and procedure is the keynote of the committee's activities.

Oleson Appointed Boston Association Manager

W. H. Oleson has assumed the managership of the Heating and Piping Contractors Boston Association. Previously he was, for six years, in the New York office of *Domestic Engineering*.

"That We May Serve to the Utmost"

The AMES PUMP COMPANY, *Inc.*

Announces

That it is now affiliated with and its products are manufactured by

THE AMERICAN LOCOMOTIVE COMPANY

THE great resources of this parent company will be utilized to make AMES pumps even more "Distinctly Different" than ever before. With unlimited manufacturing facilities and the advance design already created and perfected, we pledge an organization and a product that will serve to the utmost.

AMES PUMP COMPANY, INC.
30 CHURCH STREET NEW YORK

Affiliated with
The American Locomotive Company

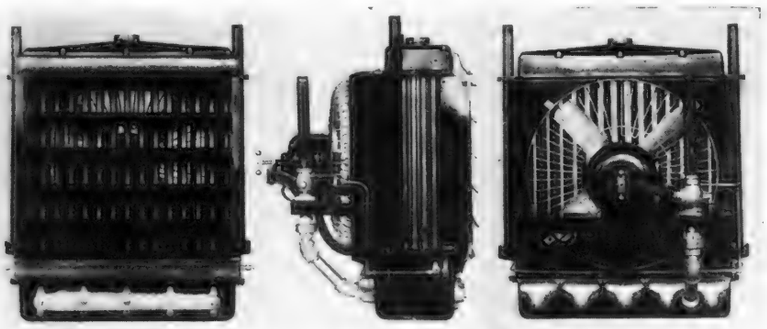
DISTINCTIVELY DIFFERENT

New Apparatus and Appliances

Gas-Fired Unit Heater Has New Features

Embodying interesting features of design, construction and operation, the Humphrey industrial unit heater has been placed on the market by the General Gas Light Co., Kalamazoo, Mich. The heater is of the suspended or ceiling mounted type, utilizing gas as a fuel, and the unit now in production has the equivalent of 400 sq. ft. of direct steam radiation with an air delivery of 1800 cu. ft. per min. of heated air.

The unit is self-contained and requires no connection except the pipe which conveys gas to the burner. This materially simplifies its installation and makes it readily removable as conditions may require.



Humphrey Gas-Fired Unit Heater

The construction of the heater is simple. Above a bank of special ni-chrome gas burners is a series of brass tube radiator elements, so arranged that the heat of combustion is equally distributed up through the tubes, the flue gases being carried away by a perforated cap flue or through an extended flue to the ceiling if the room in which the heater is installed is small. Placed in conventional position behind the tubes is a fan driven by a 1/6 H.P. electric motor. This fan drives the air through the heated tubes, and louvers at the front deflect the heated air according to their setting. The fan also delivers air under pressure to the burner box, thereby augmenting the burner output.

Heat control can be maintained by a thermostat, arranged to actuate the motor. This, in turn, is equipped with a governor that turns the gas on and off as required to maintain an even temperature. Pilot lights on either side of the burner provide for ignition and control a simple, thermostatic switch that automatically prevents the motor from operating in case the pilots are extinguished.

These automatic features make it possible for the Humphrey unit heaters to function over long periods with a minimum of attention. It is obvious that the unit heaters are especially adapted to heating requirements where steam is not required for other purposes or where, for various reasons, it is not desired to maintain boilers continuously under steam and the necessary boiler-room personnel.

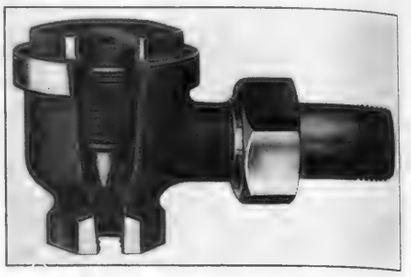
Arco Metal Pipe Ready for Market

After three years of experimenting, under the direction of P. H. Seward, to produce a pipe impervious to the effects of pitting and, therefore, adaptable to such service as return condensation lines in steam heating systems, the American Radiator Co., New York, has just placed on the market a new product known as Arco metal pipe. It is made from a special analysis ni-chrome alloy iron and is cast by a process which gives the resultant product notable ductility and tensile strength, and also, due to close grain structure, the desired corrosion- and erosion-resisting qualities. It is produced to meet the limitations inherent in gray cast-iron pipe, due to the latter's size, weight and inability to be cut and threaded on the job with standard pipe tools and with standard screw-thread fittings.

Arco metal pipe is made in 1½-in., 2-in., 2½-in., 3-in., 4-in., 5-in. and 6-in. sizes, with the same outside and inside diameters as extra-strong wrought-steel or iron pipe. Larger sizes up to 12 in., it is stated, will be available later. Standard lengths are 6 ft., but longer lengths can be obtained with either Arco metal or bronze weld. The pipe is suitable for high-pressure work, being tested up to 1000 lbs. hydrostatic pressure, according to size.

Cashin Radiator Trap

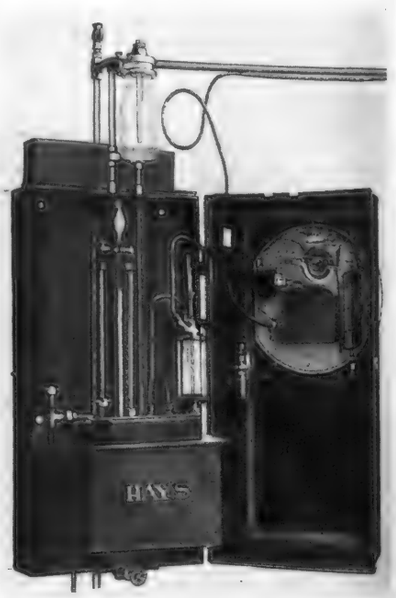
Three new sizes of radiator traps are announced by W. D. Cashin Co., Boston, Mass. An eight-fold Thermoflex-Hydron bellows is used as the thermostatic element in an extra heavy body of cast brass. These traps are made available in sizes having capacities from 150 to 500 sq. ft. of radiation.



Cashin Radiator Trap

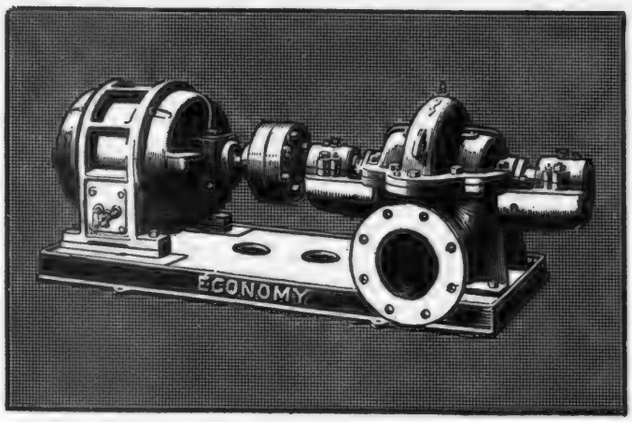
Hays Combustion Meter

Embodying many refinements, the Model "C" combustion meter is announced by the Hays Corp., Michigan City, Ind. This meter can be furnished to record CO_2 in combination with furnace draft or flue-gas temperature or as a combined recorder for CO_2 draft and flue gas temperature. The analysis portion of the instrument follows the general line of previous Hays equipment, the principal changes having been made in the recording parts. Ten-inch circular charts are used, the records on which are produced by a pen actuated by a slack leather diaphragm. This meter is made with several ranges, in the most sensitive of which a pen movement of 2½ in. is secured with a draft differential of .2 in. of water.



Hays Combustion Meter

One of a Broad Line of Famous Pumps



Economy Double Suction Horizontal Split Case Single Stage Centrifugal Pump

A recent improvement in design embodying the newest hydraulic development, enables us to feature in this pump a new high efficiency.

An all around pump for water supply, brine circulation, hot water circulation, etc., thoroughly conventional in design but with many added refinements for longer life and greater satisfaction. It offers:

High efficiencies.

Sturdy mechanical design.

Carefully designed bearings with extra large oil wells.

A large choice of cases so that an efficient pump can be furnished for any service.

Wearing rings flanged in both upper and lower half of case. No pins used.

Economy engineers, backed by 21 years' of specialized experience, are ready to cooperate in assuring correct capacities.

Write for bulletin on type of pump you require:

405 Pumps and Receivers
406 Horizontal Split Case Multi-Stage Centrifugal Pumps
407 Centrifugal Sump Pumps
408 Single-Stage Double Suction
409 Non-Clogging Sewage Pumps
410 Air Line Vacuum Pumps
411 Electric Caisson and Mine Sinking Pumps

ECONOMY PUMPING MACHINERY COMPANY

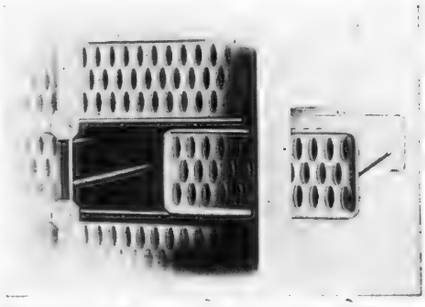
3431 West 48th Place, Chicago

Representatives in Principal Cities—Telephone and Address under Economy Pumping Machinery Co.

Economy Pumps

Oval Tubes and Removable Sections Feature Air Heater

Interesting details of design and construction are found in an air heater recently announced by the Shaw-Perkins Mfg. Co., Pittsburgh, Pa. This heater consists of a frame into which are slid, in stacks, elements made up of oval-section tubes welded into steel-plate headers. When each unit is slid into place in its guide rails, the metal-to-metal joints form a practically air-tight connection. The elements are made in four header sizes, each with 10 different lengths providing a wide range in heater dimensions and capacities. The oval tubes are staggered, so that the movement of hot gases through the heater is accomplished with a minimum of resistance. The sections are locked in position and sealed gas-tight by clamping the flanged lip on the headers to a rounded surface on the guide rail by means of bolted clamps or channels, the inner tapered face of the channels forcing the lip flange on the headers tightly against the guide rail. Ample provision is made for expansion and contraction in all directions by permitting the assembled headers to float in the main frame at one end. This heater finds a wide variety of applications in many fields, including the preheating of combustion air for boiler furnaces, the heating of air for industrial drying and baking operations, and similar applications.



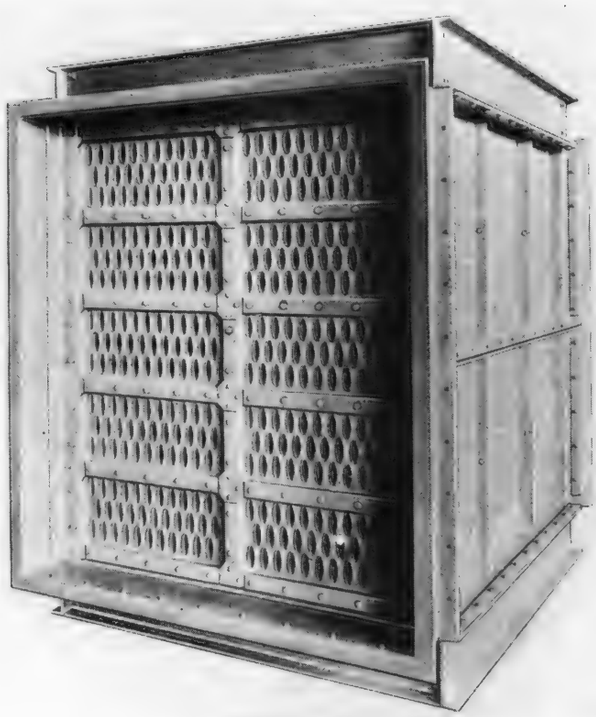
Method of Removing Section from Shaw-Perkins Air Heater

Teesdale Type TU Pump

A small automatic oil pump designed for use with pressure burners using 24° oil or lighter is announced by the Teesdale Mfg. Co., Grand Rapids, Mich. The primary function of this pump is to deliver oil to the burner's pressure pump under the gravity head determined by the height of the Teesdale pump above the burner, permitting the burner pressure pump to operate with zero suction. Extra oil from the burner pressure pump is returned to a tank in the Teesdale pump in which any air is trapped and separated and thus prevented from reaching the pressure pump.

It is stated that, under normal conditions, the cost of handling 1000 gal. of oil is about 15 cents. There are only three working parts in the pump and it is practically noiseless.

This new unit is known as the Type TU automatic oil pump.



Assembly of Shaw-Perkins Air Heater

Reznor Warm-Air Gas Heaters

The Reznor Mfg. Co., Mercer, Pa., has announced a warm-air gas heater, model 1-U.R. This heater consists of a combustion unit containing the fire and hot gases, an ornamental casing surrounding the unit, acting as a circulating chamber for the heater, and a beautiful base supporting the heater on short legs. The combustion unit is a grey-iron casting in one piece containing a large amount of heating surface and provisions for accommodating the strains of expansion and contraction. The burner is of the Reznor type, with raised and drilled ports, and cast of grey iron. The mixer and tube are connected by a machined joint. The casing is of heavy gauge sheet steel with heavy steel corner angles. Sides and ends are made of individual panels and form tight interlocking joints at the corners. Panels are electrically welded and heavily insulated inside. The heater is finished in a dark-green hard-baked enamel with stencil or decalcomania ornamentation.

The heater may be controlled simply by the gas cock, like a stove, or it may be controlled automatically by a thermostat. The capacity of the heater is 50,000 B.T.U. per hr.

Freshaire Ventilating Fan

A self-opening, self-closing ventilator has been announced by the Freshaire Division of the Paul & Beekman Mfg. Co., Philadelphia, Pa. When closed, this ventilator makes a tight fit with the window to which it is attached, and when in operation the ventilator extends itself out into the room and allows the bad air to be pulled into the fan. To install, the window is simply raised or lowered 10 in., and the expansion slide of the ventilator pulled open to fit, and fastened to the window-frame. A patented window-locking device is supplied with each Freshaire ventilator and the plug may be placed in any wall outlet or lamp socket. A special installation of the ventilator also can be supplied in a built-in type which can be built into the wall permanently. Once in the wall there is nothing to be seen inside the room except a grill, which can be finished in the room color. This, too, has the automatic self-opening and self-closing feature. Standard Freshaire ventilators are made in two window expansion types, one for windows 29 in. to 42 in. and the other for windows from 42 in. to 54 in. Other sizes are built to specification. The disc fan measures 8½ in. in diameter, and has a capacity of 425 cu. ft. of air per minute.

A dealer-factory work-together plan that cannot fail

We are proud of Preferred-Hart dealers

—because of their faith in us and in our line, faith best exemplified by the amount they invest in buildings, equipment, stock and personnel. Because of their enthusiasm, co-operation and unmatched loyalty, a type of support that has made it possible for us to offer by far the most favorable franchise of the industry.

And our dealers are proud of HART

—because our ideas of dealer support are elsewhere unheard of and unmatched. Because of this complete line that makes every home and building, with a heating plant, a possible installation. Because their first profits are mostly net profits due to superior designing that practically eliminates service work.

Home owners, too, have this pride and faith

As an example—in Baltimore, ten Hart owners grouped their finances and now control the Preferred-Hart franchise for the state of Maryland. And this Baltimore case isn't unusual. Each Preferred-Hart distributor and dealer is a true Hart loyalist, because he knows the factory, too, works just that way—with him and for him.

Never in our history have applications for dealerships come so fast. If your territory is not now covered—if you are willing to match aggressive efforts against proved plans and perfected plants—if you want a proposition unlike that of any other—write for it.

Divisional Manager Wanted

Capable experienced oil-burner salesman needed for Michigan-Ohio Division. Also other sales and service opportunities. Give all information in first letter.

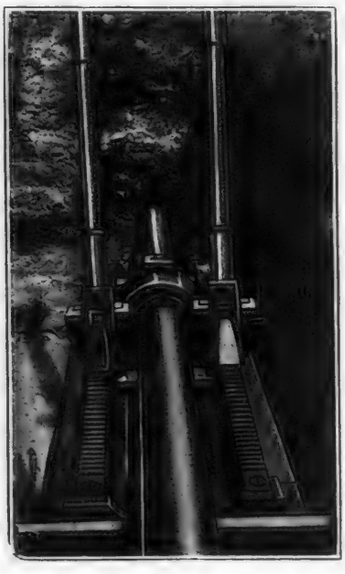
Preferred Oil Burners, Inc., Peoria, Ill.

Motor Operated Valve

A motor operated valve designed for automatic control by means of float switches, temperature controlling devices, pressure regulators or by push buttons, is announced by the Cutler-Hammer Mfg. Co., Milwaukee, Wis. The mechanism is designed for valves up to 6-in. size and although small enough to be held in one hand, has a rating of 15 lb. ft. The valve is similar to, although smaller than, a valve that has been marketed by the Cutler-Hammer Company for the last twelve years.

Simplex Jacks for Pushing Pipe Through Earth

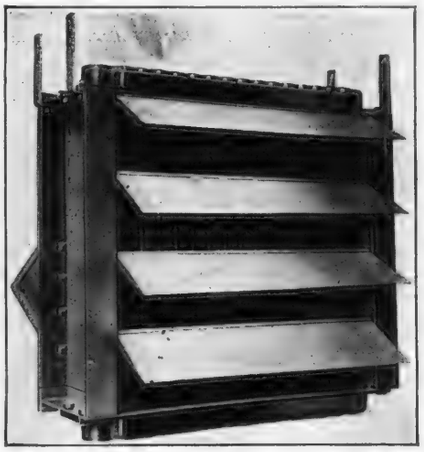
The Simplex pipe-pushing jack has been announced by Templeton, Kenly & Co., Ltd., Chicago, Ill. This device can be used whenever pipe is to be pushed through the earth. A pilot point is screwed to the end of the pipe and this jack will grip the pipe and force it through the earth. It can be operated by two or four men, depending upon the soil conditions. When solid cribbing or blocking is difficult to obtain, it is possible to hold the jack against the back pressure with one lever while the other lever is being operated. Each size of pipe requires a set of tapered jaws so that perfect gripping is obtained and the pipe will not be crushed. These machines have a 25-in. travel and the time required for pushing the pipe this distance and resetting averages five to six minutes. They can be supplied in two sizes, the first taking pipe from ¾ in. to 2 in. in diameter and the larger machine from 2 in. to 4 in.



Simplex Pipe-Pushing Jack

Trane Announces Higher Capacity Unit Heaters

An all-copper heating unit that increases capacities 50% over those obtained from the previous Trane units has been announced by The Trane Co., LaCrosse, Wis. Smaller steam-carrying tubes are used in this unit than have been used before, and there are more of them, so placed that there is even distribution over the face of the secondary surface. They are flared and rolled into cast-iron headers tested to 300 lbs. pressure. The fans are of a design developed by this company and are built especially for unit heater service, while the motors are of standard manufacture, but variable speed control can be furnished when required. Casings are so designed that the unit heater can be installed in connection with fresh-air ducts or recirculating boxes when the type of building makes such an installation a requisite. Angle plates for tilted suspension and louvres are furnished as standard equipment.



Trane High-Capacity All-Copper Unit Heater

These units have only two piping connections, as was the case with the old style Trane heaters. The pressure range is from 2 lbs. to 150 lbs. Due to ease in manufacture, it is claimed that the cost of this unit, per equivalent square foot of radiation, is reduced 20% below that of the old style. Available in three sizes, the motors of these units consume 75, 175 and 250 watts respectively when running at 950, 1140, and 1140 R.P.M. The sizes of the heaters are: 12 in. x 12 in.; 18 in. x 18 in. and 24 in. x 24 in.

Broomell Drip and Blast Trap

Designed for evacuating air and draining condensation from ends or low points of steam mains or from points of relay steam main connections to air and water return mains or to wet returns or from unit heaters, a new line of traps is marketed by Vapor Heating Co., York, Pa. These traps will handle large volumes of air and condensations and are light enough so that they readily can be installed in the pipe line without the use of brackets or supports. The body castings incorporate an air evacuating duct cast integral, and is provided with necessary inlet and outlet tappings and with a clean-out opening. Within the body is a seamless copper float attached to a bronze fulcrum lever which actuates the bronze outlet valve. The float is subjected to a pressure of 300 lbs. before assembly. The outlet valve and seat are vertical with intent to prevent the collection of dirt on the seat or valve.

When condensation flows into the trap, the air is evacuated through the air duct and bottom opening into the air-and-water return, while the condensational water accumulates in the body and raises the float, which action opens the discharge valve and permits the condensate to discharge into the air-and-water return line or into the wet return, depending upon the form of system to which the trap is applied. Immediately upon the discharge of the condensate the float drops and again closes the discharge valve. When steam or vapor follows with the condensate into the trap, the thermostatic member immediately is affected and closes the air port. The steam or vapor is condensed and is deposited in the body and eventually discharged with the condensate.

Light Duty Electric Drill

A small electric drill, rated at ¼ in., is announced by the Van Dorn Electric Tool Co., Cleveland, O. It is essentially produced as a tool-kit drill for intermittent service rather than as a shop tool for continuous operation. It is equipped with a universal motor and is built with hardened alloy-steel gears, and with the same workmanship found in the larger sizes of Van Dorn equipment.

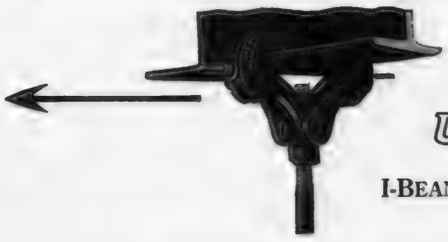
Trimo Pipe Wrench

Trimont Mfg. Co., 55 Amory Ave., Boston, Mass., has announced an improved and mightier Trimo pipe wrench. Although the contour of the frame has been slightly extended, the appearance of the wrench remains practically unchanged and the parts of the old and new wrench are interchangeable. A new method of heat treating gives greater strength and toughness to the handle and the swinging steel frame also has been strengthened. As a further safeguard, overlapping side lugs, an integral part of the handle, brace the frame against lateral distortion or spreading.

[redacted]

Jack: "Looks to me like that clamp could hold up a safe!"

Old Timer: "Well, boy, Grinnell never skimps on strength. These clamps are forged steel. Tell me they'll carry twelve times as much as we put on 'em."



I-BEAM CLAMP

The Old Timer Knows

A NEW line of patented Grinnell Universal Forged Steel I-Beam Clamps with a factor of safety of *twelve* (as called for in the specifications of the Power Piping Society) is now ready.

Only three sizes are needed to support any size of pipe from ¾ in. to 24 in. and to fit beam flanges up to 7.25 in. width for the two smaller sizes, and up to 10.59 in. width for the largest size.

These clamps permit of 1 in. *minimum* vertical adjustment after erection. They are designed primarily for use with Grinnell Adjustable Wrought Pipe Clamps, Adjustable Swivel Rings, Single Pipe Rolls, Spring Pipe Hangers, etc.

This addition rounds out the line of high-grade, readily adjustable beam clamps, hangers, etc., for power and other types of piping,—a line in which Grinnell holds an enviable reputation.

Bulletins giving cuts, dimensions and other data on above mentioned items sent on request.

GRINNELL COMPANY

Executive Office: Providence, R. I.

Branches in all Principal Cities

Power and Process Piping
Pipe Bending, Welding, etc.
Steam & Hot Water Heating Equipment
Fittings, Hangers and Valves
Automatic Sprinkler Systems

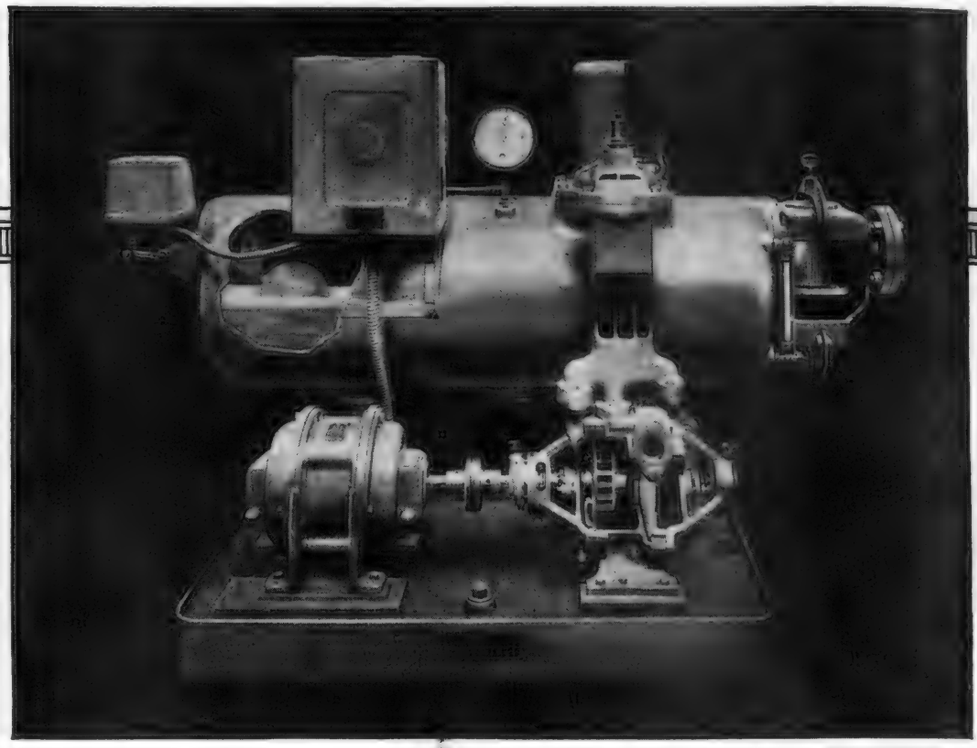
GRINNELL COMPANY, INC.
208 W. Exchange St., Providence, R. I.

I want to read more facts about the Universal Forged Steel I-Beam Clamps. Send along the Bulletins.

Name_____

Address_____

City_____



Cut-away view of a Jennings Vacuum Heating Pump. These pumps are furnished in capacities of from 4 to 400 g.p.m. of water and 3 to 171 cubic ft. of air per min. for return line heating systems of 2,500 to 300,000 sq. ft. equivalent direct radiation.

Independent controls . . .

assure low cost, trouble-free operation

TWO separate control units operate the Jennings Vacuum Heating Pump. A float switch is actuated by a ball float, which rises as the receiving tank fills with condensation, and—through a self-starter—causes the motor to start. A vacuum regulator also controls the motor through the same starter, and starts or stops it as the vacuum in the system fluctuates.

Economy is provided for in two ways. First, the pump operates only when the system must be cleared of condensation and air. Second, the pump will function on the float switch alone and at night may run only a few times—returning the condensation to the boiler and preventing the water in the boiler from dropping below the proper level.

These simplified, carefully designed controls go a long way toward making the Jennings Vacuum Heating Pump reliable and free from the need for frequent repairs or replacements. Float switch and vacuum regulator, for example, act as pilot switches and carry only the small current necessary to operate the starter magnet. The main current required to accelerate the motor passes through the heavy, quick-acting contacts of the starter.

Complete details are contained in Bulletin 85. Write for your copy.

Return line and air line vacuum heating pumps — Condensation pumps — Compressors and vacuum pumps for air and gases — Standard and suction centrifugal pumps—House service pumps — Sewage ejectors — Sump pumps — Flat box pumps—Marine pumps.

Jennings Pumps

THE NASH ENGINEERING CO 81 WILSON ROAD, SOUTH NORWALK CONN.

New Trade Publications

Wagner Small Vertical Motors are described in Bulletin No. 158, issued by the Wagner Electric Corp., St. Louis, Mo. This bulletin features small vertical motors in all types and ratings from ⅛ H.P. to 1½ H.P. A feature of this line, well brought out by diagrams, is the fact that all of these motors have the same flange or lug dimensions, making it possible for manufacturers and those using small, motor-driven machinery to interchange motors of different types and ratings on the same mounting pad. A feature brought out in the bulletin is the "labyrinth seal" which prevents the leakage of lubricant into the motor winding and produces a dust-proof, leak-proof bearing housing. The vertical motors also can be mounted horizontally or at any intermediate angle.

The line includes repulsion-induction, split-phase, squirrel cage and direct-current motors designed to run at speeds varying between 1200 and 3600 r.p.m., and to operate on 25 or 60-cycle currents.

The New "144" H. B. Smith Full Surface Radiator is the title of a publication issued by H. B. Smith Co., Westfield, Mass., describing the newest form of tubular radiators. The designation is taken from the fact that, in rating, the company allows 144 sq. in. of actual radiator surface for each rated square foot of radiator. Attention is drawn to the fact that the radiator is tested with steam rather than with compressed air. These radiators are made in three, four and six tube units with ratings from 4½ sq. ft. to 180 sq. ft.

These Users Know is the caption of a display circular issued by McDonnell & Miller, Wrigley Bldg., Chicago, and featuring the McDonnell & Miller self-cleaning duplex feeder. This sheet is well illustrated and contains a detailed technical description of this device.

Nugent Equipment is described and illustrated in a series of bulletins issued in a loose-leaf cover by William W. Nugent & Co., 410 N. Hermitage Ave., Chicago. These bulletins feature lubrication and filtration specialties used in many fields, particularly with Diesel engines, and for other applications of fuel and lubricating oil. The bulletin is replete with photographs of equipment and with pictures of plants in which Nugent specialties are used.

National Metaphram Furnace Regulators are described in a bulletin issued by the National Regulator Co., Chicago. This furnace regulator is intended only for use on recirculating warm-air furnaces. It consists essentially of a cast-iron open cage containing six hollow individual metal diaphragms called Metaphrams. The cage is fastened to a main warm-air pipe from the furnace and operates the draft and check draft by virtue of changes of temperature in the pipe selected. The action is entirely automatic and gradual in that the draft and check dampers have their positions changed gradually rather than being moved from fully opened to fully closed or vice versa. Installation is simple and adjustment is easy to make.

Comfortable Homes is the title of a small circular issued by the D. & T. Mfg. Co., 15 So. Clinton St., Chicago. The bulletin describes the J. M. electric temperature regulator which consists of an electric motor operating the check damper and the main damper of the boiler under the control of a room thermostat. The company behind this equipment has long been manufacturers of heating specialties, and as far back as 1911 introduced the then revolutionary tank-in-basement system of water heat.

Shortt Automatic Pumping Trap, manufactured by the W. B. Connor Co., Inc., 369 Lexington Ave., New York, is the subject of a folder received from this company. This trap is made in four sizes with discharges ranging from 900 to 2830 gal. per hour.

Sylphon Temperature Control is the title of bulletin H-172 received from the Fulton Sylphon Co., Knoxville, Tenn. This bulletin, which is issued for heating contractors, contains descriptions and sales talks for Sylphon temperature regulators. A message to the contractor states that there are many opportunities in every city for the installation of automatic temperature control and service hot-water. There also are opportunities to sell damper regulators to home-owners who have never been approached by salesmen for these devices.

Dayton-Dowd Centrifugal Pumps Type CS and Type CSLH are featured in bulletin 267 of the Dayton-Dowd Co., Quincy, Ill. Performance curves of these pumps are used to illustrate a description of the basic principles of their design. Cutaway views, specification tables and photographs of these units are presented in brief but complete manner. The last half of this book is devoted to photographs of installations in various plants in this and other countries. The photographs are exceptionally clear and interesting. Size 8½ in. x 11 in. Pp. 39.

More Heat from Any Hot-Water System on Less Fuel is the claim made for the Hydrolator manufactured by the Janette Mfg. Co., 556 West Monroe St., Chicago, Ill. The feature of this device is that it circulates water several times faster than it would flow by gravity. When this equipment is used the difference between the flow and return temperatures is approximately 15°, showing that a more nearly constant water temperature is maintained throughout the system. A description of the hydrolator with engineering data pertaining to it are included. This device is made in three sizes of heating systems with capacities ranging from 16 to 40 gals. per min.

Karp Sheet Steel Specialties are featured in Catalog B-1, issued by the Karp Metal Products Co., Inc., 121 30th St., Brooklyn, N. Y. These specialties include access doors, radiator enclosures, radiator shields and radiator brackets, as well as riser escutcheons and shields. Details of construction and installation are featured in this catalog.

"Put 'Warco' Vacuum Valves on the Radiators and Steam Mains" is the caption of a circular issued by W. A. Russell & Co., Grand Central Terminal, New York, featuring the Warco No. 2 and No. 6 vacuum valves. The former is designed for installation of radiators and the latter on large mains. An adjustable outlet port in the cap of the No. 6 valve, consisting of four graduated holes, permits the control of the volume of steam passing from the main, so that the system can be balanced by passing steam simultaneously to the radiators at the ends of long or short mains.

S. K. Radiafin Tubes for heating and cooling air and condensing vapor are presented in a folder issued by the Schutte & Koerting Co., Philadelphia. Incorporated in the circular are data covering the different types manufactured by the company, including seamless drawn brass and copper tubing with copper fins, seamless drawn steel tubing with steel fins, seamless drawn brass and copper oval tubing with copper fins, both designed for pressures up to 250 lbs., and standard steel pipe with steel fins designed for pressures up to 125 lbs. As the circular points out, S. K. Radiafin tubes can be bolted or welded together in various ways to form compact heating or cooling units. The tubes are sold with or without headers.

The Weather Vein, published quarterly by the Carrier Engineering Corp., 850 Frelinghuysen Avenue, Newark, N. J., contains the story of an interesting application of Carrier equipment in industry. This issue is devoted to air conditioning in flour mills.

Trade and Miscellaneous Notes

Coming Events

February 12-16, 1929. Fourth annual Midwest Power Engineering Conference and Exposition at Chicago. Headquarters at the Palmer House.

February 18-23, 1929. Tenth annual meeting of the Associated General Contractors of America in Chicago. Headquarters at the Builders Building.

April 9-11, 1929. Sixth annual convention of the American Oil Burner Association in New York. Headquarters at the Hotel Pennsylvania.

April 24-26, 1929. Annual meeting of the National Warm-Air Heating Association in Chicago. Headquarters at the Hotel Stevens.

May 13-16, 1929. Annual meeting of National Fire Protection Association in Memphis. Headquarters at Hotel Peabody.

June 11-14, 1929. Twentieth annual convention of the National District Heating Association in Detroit.

June 24-28, 1929. Midsummer meeting of the American Society of Heating and Ventilating Engineers at Lake of Bays, Ont., Can. Headquarters at Bigwin Inn.

Miscellaneous Notes

December building operations, as reported by the F. W. Dodge Corporation, show a decrease of 8% below the total for November, 1928, and a decrease of 9% from December, 1927, record. The total figures for the 37 states east of the Rocky Mountains were $432,756,300. Analysis of this record shows that 41% of all construction was for residential buildings, 19% for public works and utilities, 16% for commercial buildings, and 9% for industrial projects.

Contracts in New York State and Northern New Jersey amounted to $138,340,700, representing an increase of 2% over the total for the preceding month and 7% increase over the total for December, 1927. The New England States report a contract total of $28,222,900, which shows a decrease of 8% from the total for November, 1928, and a decrease of 9% from the total of December 1927.

In the Middle Atlantic States figures amounted to $51,962,100, representing the highest December contract total ever recorded for this area. It was 14% ahead of the December, 1927, record, but there was a decrease of 5% from the total for November, 1928. Contracts in the Pittsburgh district amounted to $39,093,800, showing a decrease of 35% from the total for November, 1928, and a decrease of 8% from the December, 1927, total.

Contracts in the Central West amounted to $120,459,500, representing an 11% decrease from the total for the preceding month and a 27% decrease from the total for December, 1927. In the Northwest contracts amounted to $3,828,000, showing a decrease of 34% from the total for November, 1928, and 74% less than the total for December, 1927.

The Southeastern States report figures amounting to $33,895,900, showing an increase of 14% over the total for November, 1928, but a decrease of 31% from the record for December, 1927.

Texas reports contracts amounting to $16,953,400, which represent an increase of 28% over the total for December, 1927, but a decrease of 12% from the total for November, 1928.

The 1928 construction volume as given in this report, was the highest in the history of the country.

Iowa State Master Plumbers Association will hold its annual convention in Fort Dodge, Ia., March 21-22. A special trip has been arranged to visit the tomb of the famous "Cardiff Giant," whose remains rest nearby. This will be the last opening of the tomb for some time. All master plumbers, whether members of the association or not, are cordially invited to attend.

National Fire Protection Association, Boston, Mass., will hold its annual meeting at the Hotel Peabody, Memphis, Tenn., May 13-16. James S. Mahan, Western Actuarial Bureau, 222 West Adams St., Chicago, has been appointed western transportation director, and C. J. Peacock, of the Underwriters' Laboratories, 109 Leonard St., New York, will be eastern transportation director.

Chicago Association of Consulting Engineers, Chicago, Ill., held its ninth annual meeting at the City Club, January 21, and the following officers were elected for the ensuing year: President, Ernest V. Lippe; vice-president, Rollo E. Gilmore, and secretary-treasurer, H. L. Clute, 307 North Michigan Ave., Chicago.

Walter J. Kohler, president of the Kohler Co., Kohler, Wis., was inaugurated as the twenty-sixth governor of Wisconsin at the state capitol in Madison, on January 7.

Important Consolidation of Control and Equipment Manufacturers

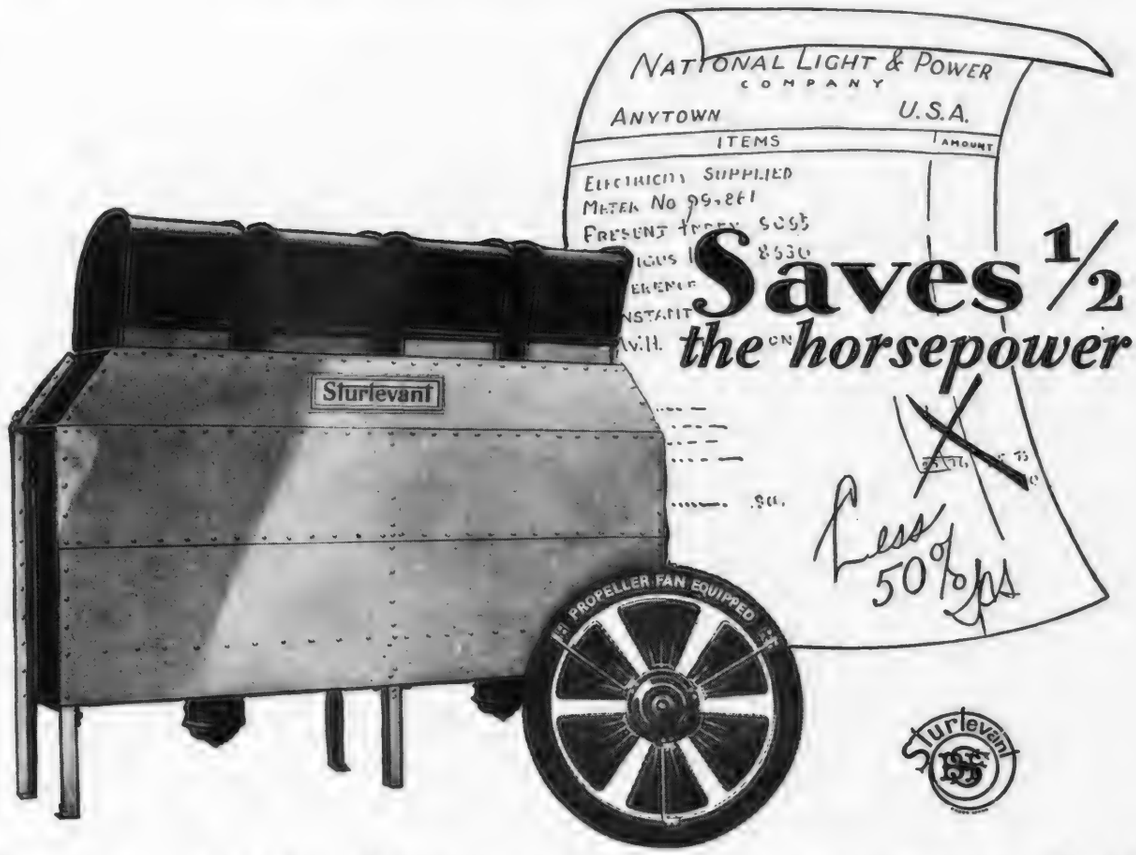
One of the most significant happenings in the industry is the recently announced consolidation of the Leachwood Co., Janesville, Wis., the Time-O-Stat Corp., Milwaukee, Absolute Con-Tac-Tor Corp., Elkhart, Ind., and the Cramblet Engineering Corp., Milwaukee, under the corporate name of Time-O-Stat Controls Company, with general offices and factory at Elkhart, Ind. This brings together four companies which manufacture kindred products with but few duplications, all of which makes an ideal combination for complete coverage in the control field.

The Leachwood Company manufactures one-piece corrugated metal bellows, thermostatic and pressure elements, refrigerator diaphragms, compressor seals, high duty refrigerator pressure and thermostatic controls and a large number of special products being corrugated metal bellows as a basic element. The Cramblet Engineering Corporation produces high wattage mercury-tube switches.

The Time-O-Stat Corporation manufactures a complete line of boiler controls for gas and coal, and the Absolute Con-Tac-Tor Corporation is well known for low-wattage mercury-tube switches and a full line of controls for oil burning, domestic and industrial heating equipment, refrigerator controls and a number of special controlling devices.

For the next few months each of the companies will operate in its respective plant as a division of the new company, but within four or five months it is expected that all will be brought together at the model plant of the Absolute Con-Tac-Tor Corp., at Elkhart, Ind. The offices of the company are: Julius K. Luthe, president and treasurer, A. I. Wallace, Paul K. Cramblet, E. J. Leach, and W. Johnson, vice-presidents. It is understood that building contracts will be let in the immediate future to greatly enlarge the offices and factory at Elkhart.

Sarco Co., Inc., 183 Madison Ave., New York, announces the appointment of Frank H. Sprague as sales manager of the company's recently created western heating division, with headquarters at the new offices in the Engineering Bldg., Chicago. Mr. Sprague formerly was sales manager of the Skidmore Corporation.



Like a 50% discount on power bills!

A touch of genius in the *design* of this unit heater assures an economy that is worth investigating!

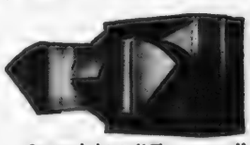
If you had the operating costs on various types of industrial heaters—you would find that the Sturtevant "Tempervane" requires 50% less current than any similar capacity heater equipped with centrifugal fans . . .

If you had two heaters—one a "Tempervane"—operating under the same conditions, your wattmeter would be a star witness—and a good salesman—for the Sturtevant unit.

The motors in a "Tempervane" are only half the size of those required in heating units equipped with centrifugal fans . . . . The "Tempervane" has especially designed *propeller* fans with all the advantages of centrifugal fans, *plus* advantages that centrifugal fans lack for this type of service.

The "Tempervane" is available in B.T.U. capacities to meet any requirement—always at 50% saving in horsepower. To save 50% on estimated current needs is to accomplish a saving that means something . . . it is exactly the same as a 50% discount on power bills . . . it deserves investigation!

It will be a pleasure to mail you a new "Tempervane" catalog containing test photographs, capacity tables, performance curves and complete engineering data. Ask for catalog No. 363.



Suspended type "Tempervane"

B. F. STURTEVANT COMPANY

Plants and Offices at: Berkeley, Cal.—Camden, N. J.—Framingham, Mass.—Galt, Ontario—Hyde Park, Mass—Sturtevant, Wis.

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Also Agents in Principal Foreign Countries

Sturtevant REG. U.S. PAT. OFF. *Tempervane* **Heating Units**

Emerit E. Baker

One of the outstanding figures in the industry, Emerit E. Baker, president of the Kewanee Boiler Corp., Kewanee, Ill., died January 1, at the Arlington Hotel, Hot Springs, Ark. Mr. Baker had been ill only two months and his death was attributed to sclerosis of the liver and anaemia. Mr. Baker was 73 years old and his name has been inseparable from that of the Kewanee Boiler Corporation, which was organized 27 years ago. Since that time Mr. Baker has been president of the corporation and has been looked upon as one of the outstanding citizens of Kewanee. He was born on a farm near Aurora, Ill., and was educated in the country schools and in the Aurora High School. At the age of 17 he entered the employ of the Anderson Steamer and Heater Company, of Kewanee, as office boy.

In 1876, he became associated with the Haxton Steam Heater Company, the successor of the concern with which he had been employed. At that time he kept books and ran errands for most of the 25 employees of the company. Following a merger with the Kewanee Roller and Pipe Mills Company, Mr. Baker became vice-president and treasurer, in which capacity he remained until a further reorganization evolved the Kewanee Boiler Company, and later the Kewanee Boiler Corporation. Mr. Baker has been prominent in civic affairs, was the first president of the Kewanee Rotary Club over a decade ago, and endeared himself to the citizens of Kewanee through his many gifts to the city.

J. C. Bixby, president of the J. C. Bixby & Son Co., Omaha, Nebr., died in his 85th year after a short illness. Mr. Bixby learned the machinist trade in the Cuyahoga Steam Furnace Company, Cleveland, O., afterward making a study of marine engineering, and later serving for seventeen years on steamers on the Great Lakes. In 1881, with G. H. Wood, a plumber of Port Huron, Mich., he opened the first plumbing and heating firm in Council Bluffs, Iowa. Two years later Mr. Bixby purchased Mr. Wood's share in the firm and continued the business under his own name until 1907, when he moved to Omaha, Nebr., and remained there until the time of his death.

James Harvey, president of A. Harvey's Sons' Mfg. Co., Detroit, Mich., died recently in his 79th year, following several years of ill health. He was born in Brooklyn, N. Y., leaving there at the age of two with his father, Andrew Harvey, for Detroit. His father purchased the foundry of Solomon Davis, the first brass foundry in Michigan. After completing his education, James Harvey became associated with the business operated by his father and brother, Andrew, Jr.

Emerit E. Baker

Manufacturers' Notes

The Ric-wiL Co., Cleveland, O., has established two new direct factory branch offices; one in Chicago at 724-725 Harris Trust Bldg., is in charge of Ralph E. Sutherland, who handled the Ric-wiL account for the Stannard Power Equipment Company, and Fred G. Austin, formerly a central station engineer with the Rochester Gas & Electric Company. The Baltimore office at 517 Garrett Bldg., is in charge of Louis G. Vance, who has handled the Ric-wiL account with Vance & Vance, as mahager of the Baltimore branch. A new department of the company recently has been established to specialize in the manufacture and sale of several new products, including vitrified cradle base for sewers, impregnated tape and a high-grade sewer joint compound.

Prossen-Meder Corp., 1834 Broadway, New York, eastern representatives for the Combustion Fuel Oil Burner Company, has appointed Alden Crankshaw as sales engineer for the New England territory, with headquarters in Boston, Mass.

International Combustion Engineering Corp., 200 Madison Ave., New York, announces that its subsidiary, the F. J. Lewis Mfg. Co., will be known as the International Combustion Tar & Chemical Corporation.

The Prest-O-Lite Co., Inc., 30 E. 42nd St., New York, has established a new acetylene plant at 1241 North McLean Blvd., Memphis, Tenn., making the thirty-sixth of the Prest-O-Lite chains. J. Brown is superintendent and C. A. Anderson, whose headquarters are at Birmingham, is district superintendent.

Kirk & Blum Mfg. Co., Cincinnati, O., announces the appointment of Brewster-Nicholas Co., 2169 West 25th St., Cleveland, as sales agents and representatives of this company in the Cleveland territory.

Wagner Electric Corp., St. Louis, Mo., has appointed N. H. Spencer to its sales force in Dallas, Tex. Mr. Spencer, for the past eight years, was connected with the Pittsburgh Transformer Company.

Chicago Pump Co., Chicago, Ill., has appointed the following new representatives: Ace Combustion & Engr. Co., 222 Milan St., Shreveport, La.; Harry Cooper Supply Co., 1224 Chemical Bldg., St. Louis, Mo.; F. L. Bunker, P. O. Box 1223, Greensboro, N. C.; L. Brandenberger, 149 W. 2nd St., South, Salt Lake City, Utah; Alfred P. Brown, Dexter Horton Bldg., Seattle, Wash.; John A. Butler, 18 Catherine St., Lynbrook, L. I.; Robert B. Brown, Newark, N. J.; J. J. Smith, 3620 Ednor Road, Baltimore, Md.

S. T. Johnson Co., Oakland, Calif., has established a downtown factory branch, display and sales office in line with the increasing demand for oil-burning equipment in the United States and foreign countries. N. W. Wilson is now district sales manager of this new factory branch. The Chace Engineering Co., 121 West 6th St., St. Paul, Minn., has been appointed distributor throughout certain counties in the state of Minnesota. Battle & Roberts, Hanford, Calif., and Canby Plumbing Co., Tulare, Calif., also have been appointed Johnson distributors in their respective territories.

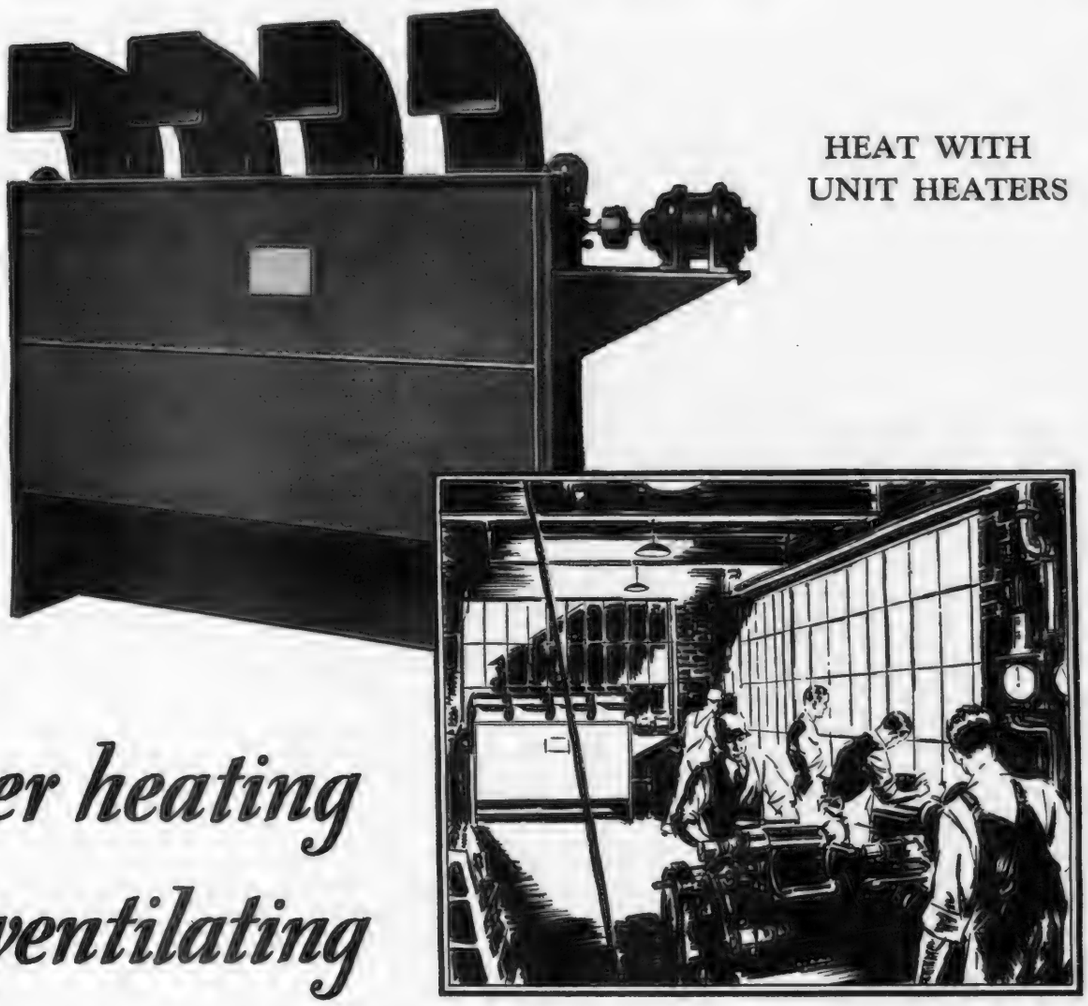
Changes in Address

Draft-A-Justor Corp., 513 West Jackson Blvd., Chicago, has moved its office to the Builders Building.

Laurie Engineering Co., 521 Pioneer Trust Bldg., Kansas City, Mo., has moved its offices to 1204 Oak Street, where additional space for displays and demonstrations has been taken.

Brown Instrument Co., Philadelphia, Pa., has secured larger quarters for its New York office at 117 Liberty Street, with M. M. Watkins district manager.

Consolidated Ashcroft Hancock Co., Inc., 100 E. 42nd St., New York, is the new central sales office of the recent consolidation. All inquiries for American Schaeffer & Budenberg Division should be directed to the company at this new office.



HEAT WITH
UNIT HEATERS

Proper heating and ventilating need not be uncertain or expensive

"It's too cold to work in here," remarks a shivering workman.

"I can't work with that window open," adds another.

"I won't work with the windows all closed," chimes a third.

And so it goes—in plants where heating or ventilating equipment are lacking or inadequate for the particular job.

It is necessary to be warm—also to breathe. Sirocco Unit Heaters are built to order for heating and ventilating large industrial areas. They are made in 28 sizes and capacities for high or low pressures, floor or ceiling applications. Before you specify heating equipment for any industrial building we ask that you see the Sirocco Unit in action—inquire of any user—or compare it with any other heating method or unit.

American Blower

"Sirocco" VENTILATING, HEATING, AIR CONDITIONING, DRYING, MECHANICAL DRAFT
MANUFACTURERS OF ALL TYPES OF AIR HANDLING EQUIPMENT SINCE 1881

AMERICAN BLOWER CORPORATION, DETROIT, MICHIGAN
CANADIAN SIROCCO COMPANY, LIMITED, WINDSOR, ONT.
BRANCH OFFICES IN ALL PRINCIPAL CITIES

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Please send me your 32-page book on Industrial Heating and Ventilating.

*Name*_____

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Advertisements under this heading, $2.00 per inch, payable in advance. A 1-in. advertisement contains 35 words. To secure insertion copy must be received not later than the 20th of the month preceding date of issue.

SALES REPRESENTATIVE WANTED—An excellent opportunity with unlimited financial possibilities, either as direct salesmen or as sales representatives, is offered covering a complete line of vacuum, vapor and steam heating specialties, a complete system of temperature regulation, fans, air washers and unit heaters.

Only those with technical education and thoroughly experienced in one or more of the lines will be considered. Give complete history of selling experience with reference to territory covered, name of company now associated with, etc. Applications confidential.

THE BISHOP & BABCOCK SALES CO.
Cleveland, Ohio

VAPOR SPECIALTY REPRESENTATIVES WANTED—Some territories open at present, particularly in the west and south. Good proposition for established men who have following with plumbing and heating contractors and architects. State territory and other lines handled. Layouts not necessary. We are an old established company. Our heating system is simple and popular. Communications held strictly confidential. Address Box 23, care of Heating and Ventilating Magazine.

REGISTERED ENGINEER—Now in private practice. Twelve years' experience in design and supervision of mechanical equipment of buildings, and some architectural experience. Desires permanent connection with an established engineering or architectural office in a responsible engineering or executive capacity. Age 36. Married. References exchanged. Address Box 24, care of Heating and Ventilating Magazine.

POSITION WANTED—Heating and ventilating engineer wishes position as engineer. Sales engineer, specialist on air conditioning. Twenty years' experience. Age 38. American. Address Box 25, care of Heating and Ventilating Magazine.

SALESMEN WANTED—By manufacturer of new type of air refrigeration. It sells for one-fifth of present price of any mechanical refrigeration now on the market. Selling organization now forming for eastern states wants men who can finance themselves to sell these units to restaurants, chain stores, etc. Commission basis. Give details as to qualifications. Address Box 26, care of Heating and Ventilating Magazine.

WANTED—Sales engineer to represent manufacturer of heating specialties; to cover territory north and east of New York City. State experience, salary desired and reference, which will be treated strictly confidential. Address Box 21, care of Heating and Ventilating Magazine.

MANUFACTURER'S REPRESENTATIVE—Manufacturer of complete line of fans, air washers and unit heaters, desires recognized representative on commission basis. Address Box 22, care of Heating and Ventilating Magazine.

POSITION WANTED—Salesman and heating engineer wishes to connect with manufacturer of heating or power equipment as sales agent or salesman. Extensive acquaintance with architects, consulting engineers, heating and plumbing contractors. Address Box 27, care of Heating and Ventilating Magazine.

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"Prepare NOW to reap YOUR share in the coming years of great business Prosperity."

HARKEN to this Command, O Ye Shop Owners, Salesmen, Mechanics, and others. Fortunes will be made in these next few years by those who KNOW. Devote this Winter to personal preparation in a technical way for going after the bigger paying jobs—the ones with the longer yearly incomes. Build big with big prosperity; our Engineering Service is at your command. Check the subject you prefer, and mail today—full information is free.

- ☐ Heating and Ventilating Engineering.
- ☐ Special Steam and Water Heating.
- ☐ Scientific Warm Air Heating.
- ☐ Plumbing and Sanitary Engineering.
- ☐ Contracting and Estimating.
- ☐ Mechanical Drafting.

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The most thorough institution for Technical Home Study to-day.

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Only to an

Executive Engineer

OUR clients will form a central bureau in New York to determine the quantities and classes of material needed to complete work as planned and specified. They require the services of a mature man with technical and practical heating and ventilating experience and outstanding executive ability to head this bureau. He should be a recognized heating engineer, at least 40 years of age, and of the highest type. His duties will be primarily executive, as he will direct and supervise the activities of expert estimators.

State age, technical training, practical experience, and qualifications in full detail, by letter only, to the undersigned. Your reply will be treated with strict confidence.

Address Box 65

Doremus & Company
Advertising Agents
44 Broad Street New York

Announcing

"Buffalo"

"Highboy" and "Lowboy" Industrial Unit Heaters

New, efficient, simple, good looking. Can be installed in vertical, horizontal or inverted position to fit space and structure requirements.

Numerous exclusive features. Write for details.

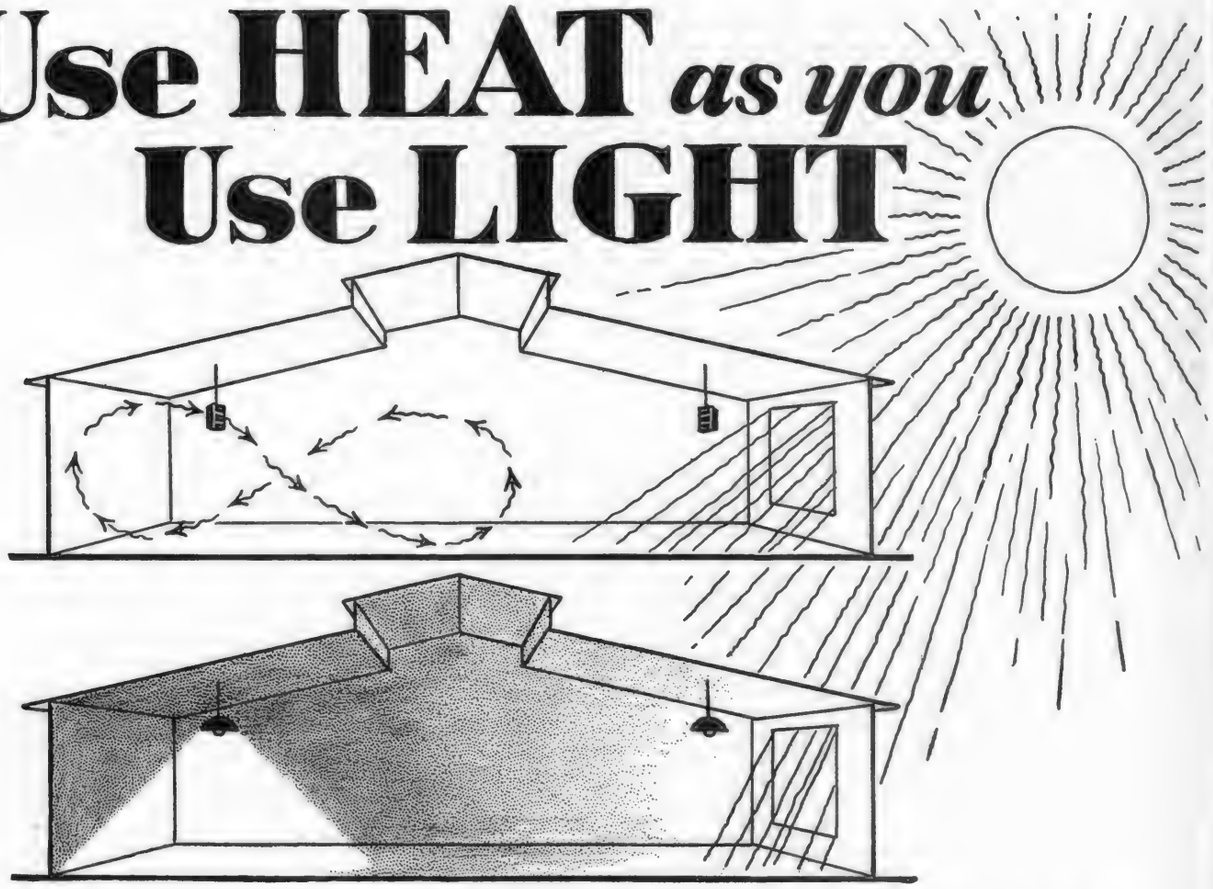
Buffalo Forge Company

480 Broadway **Buffalo, N. Y.**

In Canada: Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

See these heaters at the Chicago Power Show

Use HEAT *as you* Use LIGHT



Heat when you need it, where you need it — just as you use light.

That is what Modine Unit Heating means in the industrial plant.

The illustration above tells the story. The sunny side of the plant has ample light. The other requires additional illumination. Only lights that are needed are turned on. No waste there.

Heating is taken care of just as effectively and economically with Modine Unit Heaters, as shown in the lower picture. The Modine delivers heated air *down* where needed, just as light is reflected *down*. Individually controlled, Modine Units are operated only when the area each Unit covers requires heat. No waste. No discomfort to workmen through excessive heating or under heating.

During the last seven years thousands of industrial plants have turned to Modine Unit Heaters — for better heating at smaller cost — for increased productivity through improved working conditions — for reduced loss through illness of workers.

Let us send you complete information now about this better method of industrial heating.

Modine Unit Heater No. 701, weighs only 130 lbs., has the heating capacity of approximately two tons of cast iron radiation.

MODINE MANUFACTURING COMPANY
1707 RACINE ST. RACINE, WIS.
Branch offices in all large cities
London Office — S. G. Leach & Co., Ltd., 26-30 Artillery Lane.

Modine *Unit* HEATER

A MODINE Product

FOR STEAM, VAPOR, VACUUM, HOT WATER HEATING SYSTEMS

THERMO SYPHON TRAP

Use a trap that thinks of your boiler

operates on any one or two-pipe system

BOILERS for vacuum systems or boilers for steam pressure systems are all gainers by having THERMO SYPHON TRAPS in the basement return line. These traps prevent injury to boilers through low water, they eliminate noise by removing air pockets and water slugs.

THERMO SYPHON TRAPS are POSITIVE. A trap that isn't positive in action is worse than no trap at all.

Keeping water levels always up to the safety line is as essential to a boiler's life as checking hardening of the arteries in the human system is to the span of life of man.

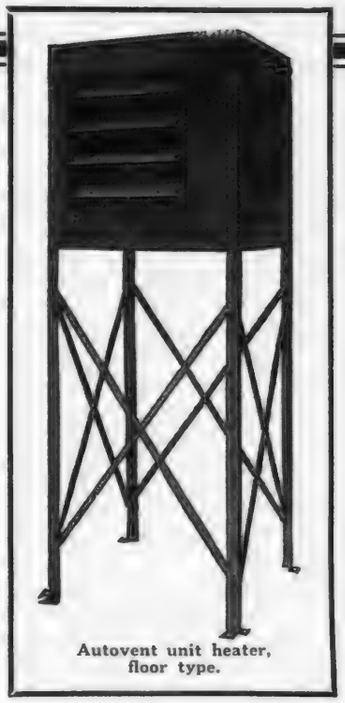
Thermo Syphon Traps lengthen the life of a boiler.

Send for Bulletin No. 16-HV giving full details. We solicit your correspondence on heating difficulties.

LYTTON MANUFACTURING CORPORATION

FRANKLIN, VIRGINIA

High Grade Return, Vacuum, Lifting and Separating Steam Traps, Reducing Valves, Blow-off Valves.



Autovent unit heater, floor type.

Special Features

Heavy duty motor. Specially designed fan wheel. Extra large pressure chamber. Tapered discharge. Performance positively guaranteed. Built for continuous duty.

Our staff of engineers is always ready to advise you on all ventilating and heating problems — without obligation.

Low Cost—High Comfort
HEAT *with* AUTOVENT
Unit Heaters

WHERE ceilings are low or of a character not suited to accommodate the ceiling type heater, the floor type Autovent unit heater gives economical heating service—controlled heat at needed points. The high outlet velocity of Autovent heaters accomplishes a highly efficient distribution of heat. Occupants of buildings find comfort and healthful conditions where circulation of air and even temperatures prevail.

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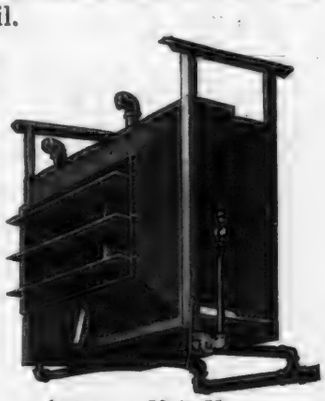
Send for literature and further details on any problem of heating or ventilating you may have.



Autovent Unit Heater, Ceiling Type

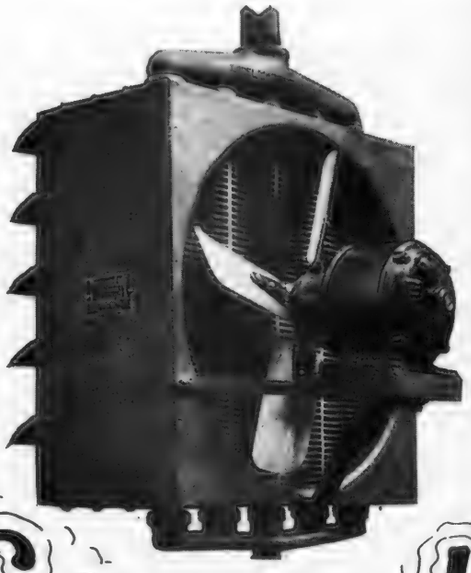
Autovent Fan & Blower Co.

1805-1827 No. Kostner Ave.,

CHICAGO, ILL.

REGISTERED AUTOVENT.

25 Seconds!



Below is a photograph of the interior of a boiler factory with a ceiling height of fifty feet in which are installed, in the upper right and left hand corners, two Thermal Unit Heaters. Two smoke bombs were lighted behind each of these heaters and—

—twenty-five seconds later, with the Thermal Unit Heaters in operation, the smoke was diffused to every point of that end of the big room, floor to ceiling, and wall to wall. That's a sample of what Thermal Unit Heaters will do in quick and thorough heat and air distribution.

THERMAL UNIT
INTEGRAL SECTION
MECHANICAL

The construction of the Thermal Unit Heater, which includes large streamline core, integrally cast, without welds, joints, flanges, or brazed or soldered connections, the airplane type extended fins, the rounded surfaces, and the special fan and motor unit, make it possible for us to guarantee the Thermal Unit Heater against any damage by freezing or corrosion. And, quickest installation, highest heating efficiency and trouble-free service are also assured.

Manufactured & Sold by

The Thermal Units Company

A Subsidiary of

The Mechanical Manufacturing Co.

Union Stock Yards—Chicago, Ill.

Eastern Office—30 Church St., New York

THE THERMAL UNITS CO.,
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"This Building is Protected Against DUST!"

When you realize that about 45 tons of dust, sand and soot settle over the average city block in twelve months — when you realize that this dust ruins interiors and furnishings and adds thousands of dollars to annual cleaning and decorating bills—and when you realize that it carries disease germs which attack the health of occupants—then the importance of adequate dust protection must be apparent.

Protectomotor Panel Air Filters are being installed in modern buildings everywhere because authentic tests prove that they *actually deliver air that is 99 9/10 % CLEAN!*

The Protectomotor Panel Air Filter consists of a fine texture felt filter medium formed in pockets over radial rust-proof wire screen fins, mounted in metal frames.

Initial cost is low and maintenance cost is practically nothing, as no oil drains or cleaning tanks are needed. It operates from 2 to 6 months without cleaning, depending on conditions, and requires but half a minute per panel to remove all accumulations with our special vacuum cleaner. The resistance can be kept below any specified static pressure drop.

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Perfect Positive Protection

PANEL AIR FILTER

TURTLEBACK

TRADE MARK

Even Distribution of Fresh Air

To insure the health and comfort of an audience in a theatre or auditorium, fresh air must be supplied evenly and constantly in all parts.

Turtlebacks meet the requirements of the architects and engineers wherever a uniformly diffused air supply at the floor line is desired. Easily installed, simply adjusted, and rigid when locked in place by the center set screw. Made of cast-iron, is unusually strong and is economical because it requires no replacements.

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The most accurate, constant and durable of expansion units

FOR LOW AND HIGH TEMPERATURES

Our No. 1800 metal for temperatures up to 350° F.
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Positive and Dependable Thermostatic Metals

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Extended Surface Radiation

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Low Air Resistance Type

A seamless Copper Tube Heater of great efficiency for all forced air heating systems. Many installations giving unequalled service.

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HELICALFIN Tubes are equipped with flat copper radiating fins. No corrugations to catch the dirt.

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Makers of Good Radiators since 1905

Service The *Satisfaction*

VECO SYSTEM of VAPOR HEATING

Write us about the Building you want to heat—any building, regardless of size, character or location. VECO gives the same good service wherever installed.
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All Capacities for All Air Cleaning Purposes

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Cleans the air, washes itself and ejects the accumulated dirt entirely without human aid. No screens to change or clean. Patented two-stage, slitted-surface filter media gives maximum possible cleaning efficiency. Fully illustrated, easy-to-read catalog gives all details. **WRITE FOR A COPY.**

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Manufacturers of Air Cleaning and Conditioning Equipment, Air Filters, Air Washers, Spray Nozzles

"Heat with Unit Heaters"

COMET
UNIT-HEATERS

THE wide-spread preference for Comet Unit Heaters is indicated by this partial list of orders for or from the following nationally known users, during the past few weeks.

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Hangars Nos. 2, 3 and 4
37 unit heaters (ceiling type)
22,000,000 B.T.U.'s per hour

Reo Motor Car Company, Lansing, Michigan
17 No. 100 floor type unit heaters
16,000,000 B.T.U.'s per hour

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114 unit heaters (ceiling type)
32,000,000 B.T.U.'s per hour

Deere & Company, Waterloo, Iowa
87 No. 60 ceiling units
40,000,000 B.T.U.'s per hour

Comet Unit Heaters contain no cast, soldered or brazed materials and are guaranteed to withstand unlimited steam pressure. They will resist rust, corrosion and oxidation for the *lifetime of the entire heating system.*

The guaranteed performance at various pressures given in Bulletin 105 tells the story. Write for your copy.

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FAN FURNACES
UNIT-HEATERS

The NEW YORK BLOWER COMPANY

GENERAL OFFICES
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FACTORIES AT LA PORTE, IND. AND CHICAGO, ILL

The HYDROLATOR used with a Taco Heater on a large hot water supply job

Make New Profits Curing "Sick" Hot Water Systems

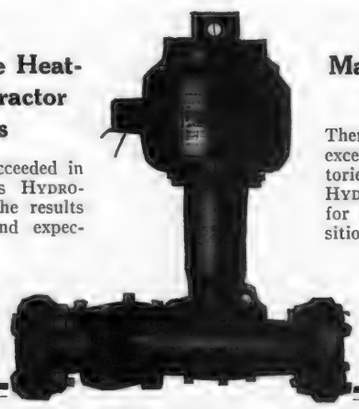
NOW is the time of year when home owners with "sick" hot water systems are cold and uncomfortable . . . and looking for a way to boost the efficiency of their heating plants.

Heating contractors who install the HYDROLATOR are reaping a harvest of these "sick" hot water jobs. This new, yet thoroughly proven device clears up practically any kind of hot water circulation trouble. Its cost to the home owner is low....and the contractor's profits are generous.

Write for Bulletin 828-H

What One Heating Contractor Says

"We have succeeded in installing this HYDROLATOR and the results are far beyond expectation."



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There are still some excellent sales territories open on the HYDROLATOR. Write for attractive proposition.

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Do Big Business by Installing our **Baked Enamel Shields** and **Art De Luxe Cabinets,** as every radiator installation means a ready and almost **Certain Prospect** for the **Sale** of our **Shields** or **Cabinets.**

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Write for Prices and Dealer Agreement.

ACME RADIATOR SHIELD CO., Inc.
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NEW - ADJUSTABLE VARYING SPEED MOTOR
Controls amount of Heat

The totally enclosed, waterproof Adjustable Varying Speed Baldor Condenser Motor has three speeds which provides for the amount of heat units thrown off the heater by a turn of the switch. Numerous installations are all giving perfect satisfaction. No commutator. No brushes. No centrifugal switch. Ball bearing. Quiet. Compact. High efficiency. High power factor. Low starting current. Low running current. Low temperature rise. Send for complete information.

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which means, of course, that the Heat-Surface installed is

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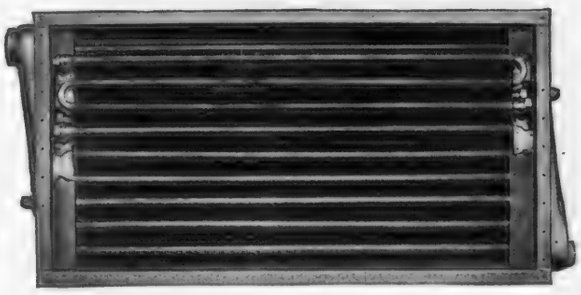
The Standardized Light-Weight Fan System Heat-Surface

LOW PRESSURE AEROFIN, *Tube-Plate Construction, for pressures up to 50 lbs. gauge.*



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UNIVERSAL AEROFIN, *continuous seamless tubes, multiple-coil construction, for pressures from 2½ to 150 lbs. gauge*

All Units in standardized steel Casings, ready for Pipe and Duct connections

Complete Information, with Piping Diagrams in colors, upon request to Newark

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are exhausted:—

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battery rooms;
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Duriron exhaust
fans are efficient,
and they are
permanent.

No coating, treating
or lining necessary.

Capacities from
fifty to five
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You sell satisfaction when you sell
Teeple Controls

ELECTRIC GAS VALVE

Customers expect accuracy and reliability in temperature controls. They are sure of these qualities when you sell them Teeple instruments. They meet every problem of heat control for gas furnaces and boilers; unit heaters; refrigerating plants; ovens; furnaces; and automatic coal and oil burners. You can recommend them.

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TEEPLE TEMPERATURE Controls
for GAS — STEAM — WATER — AIR

For 1c

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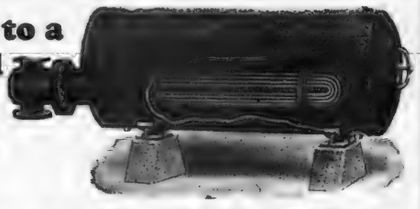
Built up to a standard —not down to a price



The rapid growth in the sale of O. E. F. storage heaters bears testimony to correctness of design and high standard maintained.

U-tube and straight tube types; steel flange quality; heavy gauge seamless drawn copper tubes; expanded into rolled steel tube sheets. Write for further details.

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WHAT'S WRONG ··WITH THIS·· PICTURE ?

Absolutely nothing! It is a perfect installation of a No. 31 Armstrong Steam Trap on a unit heater. It is compact, neat and efficient—good for a long period of uninterrupted, dependable service.

Armstrong Traps keep the coils free of condensate and air, and will not permit the escape of live steam irrespective of steam pressures and temperatures.

We will gladly cooperate with engineers and architects in determining the proper kind of trap for any type of heating installation. This service does not obligate you in any way. Send for catalog.

No. 30

No. 31

The Nos. 30 and 31 Armstrong Steam Traps commonly used for individual draining of unit heaters.

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District Representatives in 40 Cities

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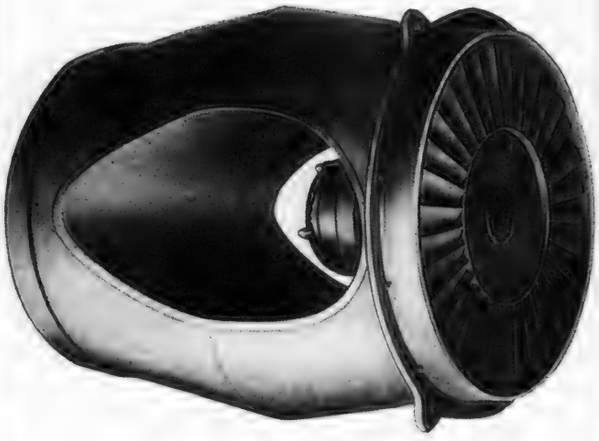
DE BOTHEZAT BIFURCATOR

The new ventilating device securing the perfect protection of the motor from:

dust, acid fumes, hot, smudgy, greasy air.

No extended shaft used nor bending of ducts necessary.



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For special ventilating jobs where fumes of excessive temperature or corrosive character are to be removed. The bifurcator is a device that permits the use of a *straightway duct*. It eliminates right angle bends and long shaft connections, at the same time protecting and automatically cooling the motor. A *short shaft* connects the fan to the motor, which is located in a transverse opening through the duct. The fan chamber is *stream lined in* section, and the *bifurcated duct is not reduced in area at this point. Full details on request.*

Simple, Highly Efficient, Trouble Proof —Yet Inexpensive—

You cannot find a more compact and powerful device than the De Bothezat Bifurcator used in conjunction with the *De Bothezat Disc Pressure Fan,* well known for its *high efficiency, high static pressure* and *non-overloading power characteristics.*

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BOOKS ON HEATING AND VENTILATION

THE DESIGN OF GRAVITY-CIRCULATION WATER HEATING SYSTEMS, by F. E. Giesecke, Ph. D. A book, remarkable for its conciseness and clearness of expression, which contains the essence of the information needed for the proper design of gravity water heating systems, based on the principle that the frictional resistance must equal the force maintaining flow. The importance of the presentation is evidenced by the fact that the entire water heating section of the A. S. H. & V. E. Compendium of Modern Practice has been discarded and replaced with a new section by Doctor Giesecke, embodying the methods here presented in detail. 64 pages of text and 10 pages of tables and charts. Price, $3.00.

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HEATING AND VENTILATION, by Charles W. Brabbée. This is the first American edition of the famous Heizungs-und Luftungstechnik, by Dr. H. Rietschel, and C. W. Brabbée, translated from the seventh German edition, edited and revised to make it adaptable to conditions in the United States. Supplemented by 7 charts covering steam and water heating and ventilation. Size 6 x 9 in. 332 pp. cloth $4.00

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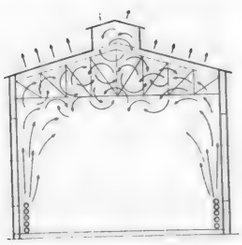
THE HEATING and VENTILATING MAGAZINE
101 W. 31st ST., NEW YORK

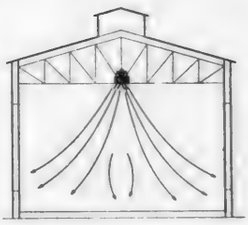
Consult

Pages 168-170-172-174
Engineers'
Specification
Index

WING FEATHERWEIGHT



Are You Buying Heat F. O. B. or *Delivered?*



You want heat *delivered* at the working level of a building—not, as with most heating systems, wastefully stored overhead in the form of overheated air. Such heat can only descend to warm your workmen after this hot air, which has risen from your heating coils, has gained weight by loss of temperature.

This loss of temperature is a high "freight charge" for getting heat down to the working level. It is heat wasted by transmission through the roof into the winter air—a "delivery cost" paid in increased fuel bills.

You save this expense by using *Wing Featherweight Unit Heaters* which deliver the air they heat to the working level.

Wing Heaters are located directly overhead. They use the highly efficient Wing Scruplex Propeller Fan to direct large volumes of heated air vertically downward at sufficient velocity to penetrate to the floor level. With Wing Heaters all the air you heat is *circulated* and mixes with the air beneath. Special discharge outlets are used to insure the distribution of the warm air evenly over the floor area.

If your business involves plant heating you will be interested in knowing more about Wing Heaters. We have a new illustrated catalog for you that tells the story graphically.

"Heat with Unit Heaters"

L. J. Wing Mfg. Company

158 W. 14th Street NEW YORK, N. Y.

H C Type Unit with Vane Discharge as shown in illustration.

L C Type Unit suitable for installation close to ceiling.

UNIT HEATERS

"Who'd ever think it was Zero outside?"

HOME owners (and their wives) universally acclaim the Newport, as their best friend. It requires so little attention for the abundant heat it delivers to all rooms,—and this—it burns the lower priced fuels.

Increase your business and profits by installing Newports. Advantages of convenience and economy when estimating take you out of "The have to meet the price competition" that means no gain for you.

Newports burn coal that costs $5.00 or $7.00 less per ton—No. 1 Buckwheat coal—It cuts fuel budgets 30 to 50%.

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NEWPORT BOILERS

It will pay you to investigate. Send us your name and we will forward free a book that explains why the public want Newport Boilers.

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Distributors in all principal cities in U.S. and Canada

INSTALL A Vapor Heating System

That Saves 20% on Installation Cost

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INVESTIGATE

The Gorton Single Pipe Vapor Heating System

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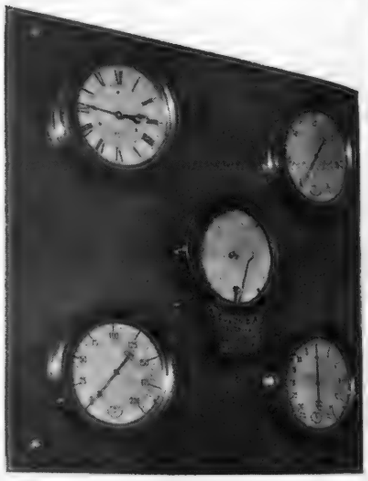
GAUGE BOARDS



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Write for the following Catalogs:

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Recording Gauge Catalog E-14,
Gauge Tester Catalog D-14,
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Dial Thermometer Catalog G-14,
Recording Thermometer Catalog H-14,
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AMERICAN INSTRUMENTS

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Subsidiary of Manning, Maxwell and Moore, Inc.
100 East 42nd Street, New York City

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Why they are so comfortable in this Odd Fellows Temple...

IN this rendezvous of good fellowship in Springfield, Mass., there is an interesting example of modern heating and ventilation...There are fourteen Sturtevant Silent Unit Ventilators performing in lodge rooms and in the spacious auditorium.

Here are some of the high spots of unit ventilator service which keep this Temple air-comfortable... always!

They are used for rapidly heating up any part of the building by recirculating the air...They keep the building air-pure and warm by bringing in outdoor air, filtering it clean and tempering it...They provide ventilation without drafts ...They do not require duct work of any kind...They are compact, handsome in appearance and SILENT!

Sturtevant Unit Ventilators provide a logical means of heating and ventilating Schools, Clubs, Churches, Public Buildings, Offices, Show-Rooms, Shops and Residences. Pictures of many of these installations are shown in a new Data-Catalog just issued. It will be helpful and suggestive to you—and it will be a pleasure to mail you a copy of this 40 page book on request — no obligation whatever!

Sturtevant

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The Silent Unit Heater-Ventilator

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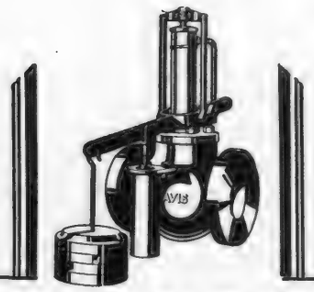


ENGINEERED FOR RESULTS

Accurate pressure control is engineered into the Davis Pressure Regulator. A balanced disc, unaffected by high pressure fluctuations, automatically throttles the flow. A steady, constant service pressure of any amount is had by simply balancing the pressure by counterweights. A simple design assures efficient results.

G. M. DAVIS REGULATOR CO.
436 Milwaukee Avenue, Chicago, Illinois

DAVIS AUTOMATIC VALVE SPECIALTIES

H&V 2-Gray

ROSS
Crosshead-GUIDED Expansion Joint Excels in

Design, Construction and Workmanship
Over 60% of sales—Repeat Orders
Once Used—Always Demanded
Every Purchaser—A Customer

ROSS HEATER & MFG. CO., INC., BUFFALO, N. Y.
New York, Chicago, Philadelphia, Boston, Cleveland, St. Louis, Detroit, Pittsburgh, Baltimore, San Francisco, Seattle, Denver, Salt Lake City, Omaha, Montreal, Toronto.

P-H-I-L-L-I-P-S
Self-Drilling Expansion Shells

Make their own hole and stay tight permanently. Just drive them into place. For jobs that must be done quickly and thoroughly. Particularly adaptable to sprinkler work. A new drill for every hole.

Phillips Drill Company
1537 Cortland St., Chicago

Write for full details

Watch Your Bends!

The clean metal and uniform gauge of Wolverine tubing has secured and held many of our largest customers. It bends without flaw. Send us your specifications.

We want to quote where quality counts

WOLVERINE TUBE CO.
SEAMLESS COPPER BRASS & ALUMINUM
1415 Central Ave., Detroit, Michigan

Sales Offices: Cleveland; Chicago; Atlanta; Los Angeles; Denver; Rochester, N. Y.; Dayton, Ohio; New York City; Dallas, Texas.

ANNOUNCEMENT

Many months of exacting research, study, and careful tests, permit us to announce

The MERCOID INTERLOCK

A complete automatic control combined in one unit. Has a variety of applications. Something the trade has been looking for.

Full Description Given in January Issue of "Mercoids." Write for Copy

THE MERCOID CORPORATION
564 WEST ADAMS STREET
Chicago, Illinois, U.S.A.
New York Office: 25 Church Street, New York, N. Y.

MERCOID
System of
DIRECT CONTROL

MERCOID CONTROLS

Two Methods of Heating

1st Sufficient Fuel (regardless of cost)
2nd Minimum Fuel (abundance of heat)

Conserved with *Athey* **Cloth-Lined Metal Weatherstrips**

Four times actual dimensions.

Notice how completely ATHEY Weatherstrips, seal the window against drafts, dust, and smoke by the cloth-to-metal contact—the most thorough method devised that makes windows weather-tight for the life of the building without making them hard to open and close.

Heating Engineers are fast learning the science of estimating radiation with the heat conservation resulting from ATHEY Cloth-Lined Metal Weatherstrips taken into consideration.

Hundreds of Office Buildings, Hotels, Hospitals, Schools, etc., as well as thousands of private residences all over America are enjoying the results of the most profitable investment in connection with their buildings.

Athey Cloth-Lined Metal Weatherstrips change any wood or steel window from a rattling, loose, drafty sash to one that works smoothly and quietly and is absolutely draft-proof when closed.

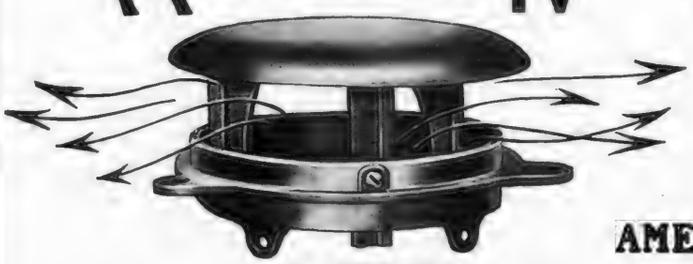
Write for Catalog

ATHEY COMPANY

6027 W. 65th St., CHICAGO

Representatives in all Principal Cities and in Canada

KAUFFMAN



AIR DIFFUSERS

SINCE 1908

Kauffman Air Diffusers

HAVE BEEN IN USE IN

Some of America's Finest Theatres

Simple to Install—Low in Price
Graduated Air Control

AMERICAN METAL PRODUCTS CORP.
ST. LOUIS, U. S. A.

CENTRAL STATION STEAM CO.

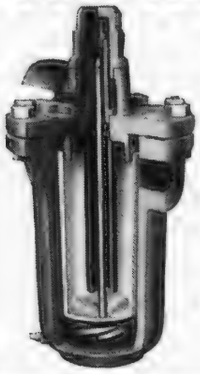
2912 East Woodbridge St.
DETROIT, MICHIGAN

MANUFACTURERS OF

Cadillac Condensation Meters
Detroit Feed Water Meters

Packingless Expansion Joints and other special fittings for underground steam distribution mains.

Trerice Steam Trap



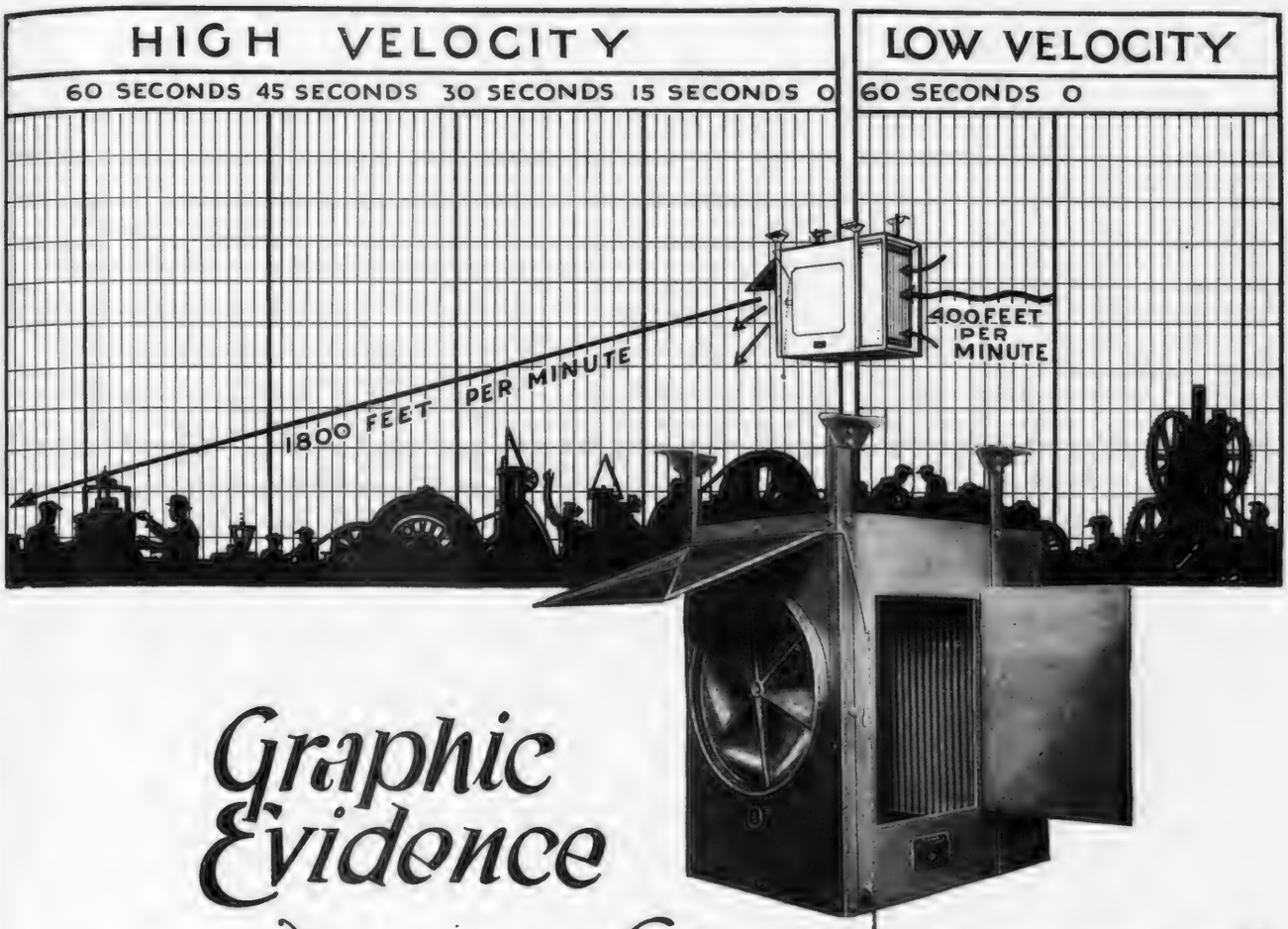
Revolving valve cleans seat and produces uniform wear on same.

High chrome steel valve and seat. Sent anywhere for free trial.

Some good territory still available. Liberal contracts. Stock sent on consignment.

Write for full particulars to

H. O. TRERICE COMPANY
1338 West Lafayette Blvd.
Detroit, Michigan


HIGH VELOCITY
60 SECONDS 45 SECONDS 30 SECONDS 15 SECONDS 0
LOW VELOCITY
60 SECONDS 0
1800 FEET PER MINUTE
400 FEET PER MINUTE

Graphic Evidence of the Effectiveness of ILG Unit Heaters

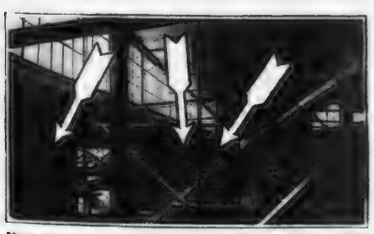
Note

Visitors to the Mid-West Power Conference to be held in Chicago, February 12-16, 1929 are invited to visit the Ilg plant and make an interesting trip of inspection.

NOTE that the ILG Unit Heater takes the air at *low velocity* and discharges it at *high velocity* — which defines low power consumption, and maximum heating capacity, and assures no agitation of floor dust.

Every 60 seconds it delivers 1,000 to 15,000 cubic feet of tempered air to the breathing zone—depending on the size of the unit. A patented deflector directs the heat waves to floor; the temperature variation between the ceiling and the floor is less than 15 degrees.

The ILG Unit Heater is the only one built with a fully enclosed self-cooled motor propeller fan. The complete outfit is made, tested, sold and guaranteed as a complete unit. Clip, sign and mail the coupon for new Pictorial Bulletin.



Nash Motor Company, Kenosha, Wisc., where 35 ILG Unit Heaters are used.

ILG ELECTRIC VENTILATING CO.
2858 N. CRAWFORD AVENUE
CHICAGO, ILLINOIS

HIGH EFFICIENCY TRADE ILG MARK VENTILATING MACHINERY

Unit Heaters

They take the air at Low Velocity and deliver it at High Velocity.

COUPON

Without obligation please send us a copy of the new ILG Unit Heater Pictorial Bulletin.

Name _____

Full Address _____

_____

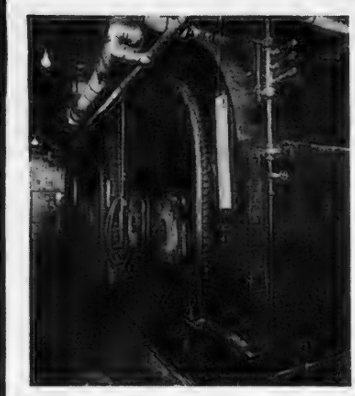
The Marlboro Hall in Chicago is comfortable in the coldest weather, thanks to the dependability and efficiency of their 3

TITUSVILLE BOILERS

Here is an ultra-modern apartment hotel which stands as a monument to the trustworthiness of Titusville Boilers and which is typical of the many fine Chicago buildings that are Titusville equipped.

Installed in 1923, these Titusville Boilers have rendered such excellent service that the management of the Marlboro will take pleasure, in testifying to the merits of Titusville to anyone interested in first hand information.

The Titusville Iron Works Company
TITUSVILLE, PENNSYLVANIA



SALES OFFICES:
New York: 152 W. 42nd Street
St. Louis, Mo.: 401-2 Bk. of Commerce Bldg.
Washington, D. C.: 626 Woodward Bldg.
Detroit, Mich.: 204 Owen Building

SALES OFFICES
Buffalo, N.Y.: Marine Trust Building
Chicago, Ill.: 111 W. Monroe Street
Pittsburgh, Pa.: Farmers Bank Bldg.
Charlotte, N. C.: 705 Realty Building
Los Angeles, Calif.: 940 Maple Avenue

TITUSVILLE BOILERS

Nobody can dodge these heating facts

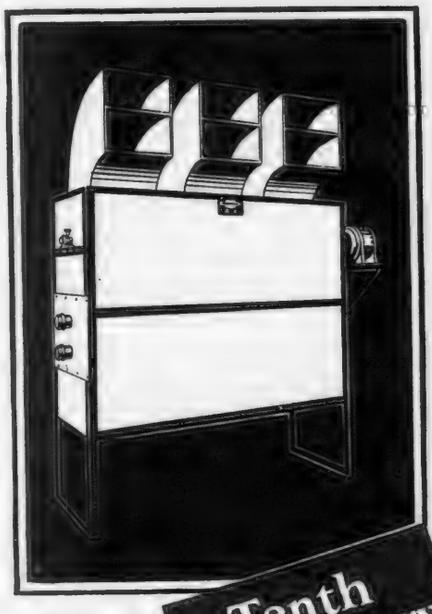
1. Air is most easily moved *horizontally,* within its own temperature strata.

2. Cool air at floor level moves most easily along the floor.

3. High-velocity discharge of heated air plus floor-level intake gives maximum even distribution of heat in the working zone.

4. Multiple Outlets give selective distribution and increased induction effect.

WHEN you have a building to heat, do it by utilizing the *basic laws of heat travel.* Remove cool air with the least effort. Distribute your heated air the easiest way. Your heating bills will be minimized and your building evenly warmed. York Heat-Diffusing Units utilize the *basic laws of heat travel*—and get most economical results. That's why York production is by far the largest in the Industry, and York users read like a Blue Book of Big Business. Ask questions of the nearest York sales representative. He's a qualified engineer—or write for information to "Heating Headquarters," *York Heating & Ventilating Corporation, 1539 Sansom Street, Philadelphia.*



YORK
HEAT-DIFFUSING
UNIT

YORK Heat-Diffusing Unit

YORK HEATING & VENTILATING CORP'N, PHILADELPHIA

Selling *Efficiency* Means Selling Efficiently

UNIT heaters have achieved their present wide acceptance because they represent a considerable improvement in efficiency over older types of radiators.

Complete automatic control makes any unit heater still more efficient—enables it to produce a comfortable, work-fostering temperature at all times and at the lowest possible cost. No heat is wasted, no electric current is wasted, when the unit heater is controlled by automatic instruments. There is, inevitably, waste when the human element assumes control.

This company manufacturers complete lines of control instruments, suitable for all types of unit heaters. They are easily installed, and reasonably priced. Bulletin 141H tells all about them. You will profit by reading this bulletin.

Time-O-Stat
CONTROLS COMPANY

is a consolidation of

LEACHWOOD COMPANY
Janesville, Wisconsin
TIME-O-STAT CORPORATION
Milwaukee, Wisconsin
ABSOLUTE CON-TAC-TOR CORP.
Elkhart, Indiana
CRAMBLET ENGINEERING CORP.
Milwaukee, Wisconsin

Correspondence should be directed to each of the four companies, just as heretofore, until notice has been given that all the general offices have been consolidated and moved to Elkhart, Indiana.

Time-O-Stat
CONTROLS COMPANY
ELKHART - - - - - INDIANA

Papa—Mama and the Baby

is just a way of identifying our Steam Coil & Direct Fired Unit Heaters together with the latest addition to the Family—Pecco Jr.—"Low In Cost, High in B.T.U."—A size for every job.

"They Keep The Whole Place Warm" is not merely a slogan, it's the honest guarantee of a line of Unit Heaters that merit the full confidence of every Heating Engineer and Contractor today.

"HEAT WITH UNIT HEATERS"

St. Louis Blow Pipe & Heater Co., Inc.
1948-60 N. Ninth St., ST. LOUIS, MO.

MANUFACTURED WEATHER

Carrier
AIR CONDITIONING
DRYING
REFRIGERATION

See our detailed data in A. S. H. & V. E. Guide.

makes
"Every day a *good* day"
Air Conditioning
Humidification, Dehumidification
Centrifugal Refrigeration
Cooling of Public and Industrial Buildings
Temperature and Humidity Control
DRYING AND PROCESSING
Carrier Engineering Corporation
Offices and Laboratories
NEWARK, NEW JERSEY

SALES OFFICES
New York Philadelphia
Boston Chicago
Cleveland
Los Angeles
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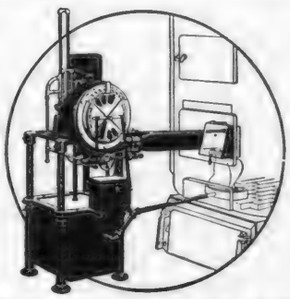
Washington

Literature on request. Write concerning your specific problem.

Continuous Flame

No Gas Pilot
No Electric Ignition

Distributors
Write for the 1928-29 Sales Plan



McILVAINE OIL BURNER
Listed by Underwriters

Dependable Heat

Graduated Automatic Control
Mechanical Draft

McILVAINE BURNER CORPORATION
Dept. H 745 Custer Ave.
EVANSTON, ILLINOIS

Outstanding
Air Filter Developments of the past year—

Dry Filtering Medium (The National AIRMAT)

Filtering medium is a dry fibrous mat, changed without soiling hands.

Built in sections, permitting flexibility in capacity and installation.

First cost and maintenance costs are low; no "extras" required.

Efficiency is high and space is conserved by the AIRMAT.

Oil Filtering Medium (The National TOOPAS)

Filters air twice through endless curtain on viscous film principle.
Built in sections, standard widths and any required height.
No oil entrainment; uses immersion principle of cleaning.
Easily serviced and possesses advantage of time-tested Phoenix Filter.
Provided with or without motor drive and is easily installed.

Send for valuable bound set of bulletins on air filters. No obligation.

NATIONAL AIR FILTER COMPANY NATIONAL

5130 Ravenswood Avenue, Chicago, Illinois

Latest Improvements in Unit Heating and Ventilating

backed by 38 years of specialized experience

Many important new features have been developed for PeerVent Heating and Ventilating Units during the past several months. In fact, *all* of the important features — radiator, motor, fans, and controls—have been improved. These improvements, made by the pioneer manufacturers of Heating and Ventilating Units, should have your careful consideration.

Adjustable motors are now standard equipment on PeerVent Units. Each Unit can be equipped to deliver the exact C.F.M. capacity required. If the C.F.M. requirements change at any time, the capacity of the Unit can be changed accordingly.

PeerVent Units can now be equipped with the PeerTherm Control as an integral part of the Unit. This device controls the fresh-air damper. Details and specifications on request.

Peerless Units built *fifteen years ago* are still in service and giving perfect satisfaction.

PEERLESS UNIT VENTILATION CO., Inc.

BRIDGEPORT, CONNECTICUT

SELLING AGENTS IN PRINCIPAL CITIES FROM COAST TO COAST

PEERVENT

HEATING AND VENTILATING UNITS

AFTER 500 YEARS NO RUST

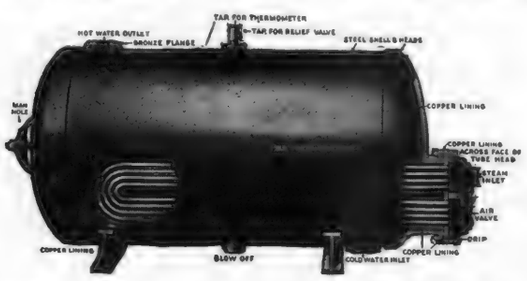
Temple of Heaven, Peking

For more than 500 years one *copper* roof has protected the Temple of Heaven, Peking. King Tut-Ankh-Amen's headpiece, made of copper, was thousands of years old. Copper is practically *everlasting*.

To give Patterson Indestructo Copper Lined Heaters the rust-resisting, non-corrosive properties of copper, we install a complete copper lining in the steel shell. As water does not touch anything except copper, there is no possibility of rust.

We guarantee the Patterson Indestructo to prevent discoloration of water from rust. Add to this the other super features of the Patterson Indestructo Hot Water Heater and you will understand why this everlasting heater is fast replacing other makes.

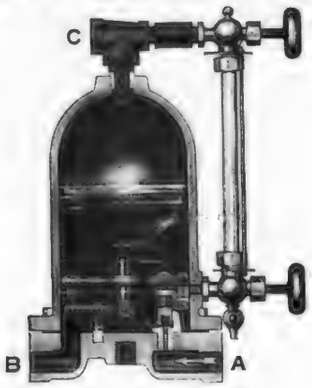
Our catalog gives full details. Write for a copy.



The Patterson-Kelley Co.
107 East 40th St., New York City

Patterson
Indestructo Hot Water Heater

KIELEY



THERE is a Kieley Water Feeder for every service. Free from complicated parts and easy to install and repair, they are chosen where full protection at low cost is desirable.

Kieley & Mueller, Inc.
34 West 13th Street, New York City

See
ENGINEERS'
SPECIFICATION
INDEX
Pages 168, 170, 172, 174

CONTROL THE SPEED
OF YOUR VENTILATING EQUIPMENT!
REGULATE WARM AND COLD AIR VOLUME

WITH THE TIME TESTED
HORTON
VARIABLE SPEED
PULLEY

HORTON MANUFACTURING COMPANY
3008-3016 University Avenue S.E. Minneapolis, Minn.

MINNEAPOLIS REFERENCES
Morgan-Gerrish Co. Richardson-Boynton Co. Vroman Cook Co.
American Foundry & Furnace Co., St. Paul

Automatically reduces the boiler limit when the outdoor temperature rises and increases the boiler limit when the outdoor temperature falls

Announcing the

HIGH VOLTAGE

(10 amperes at 110 volts)

RAYMOND

DUO-STAT

THE WEATHER-COMPENSATING BOILER CONTROL

Guaranteed

To give closer control of room temperature

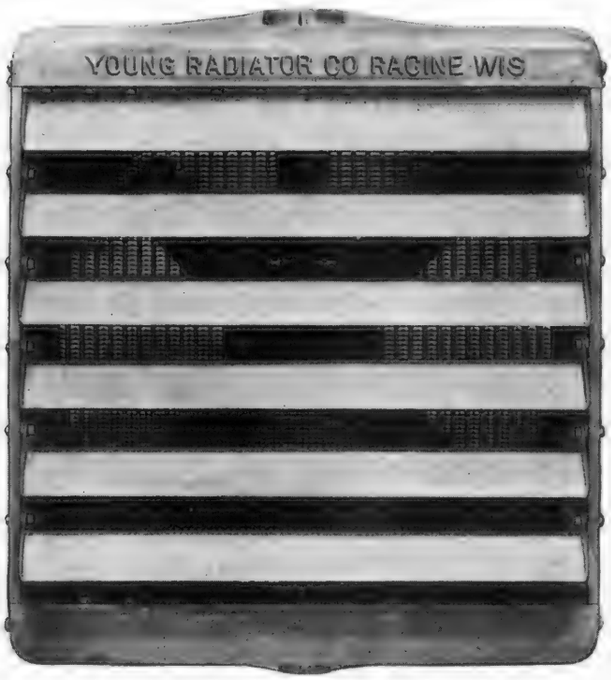
To eliminate overheating

To eliminate "cold 70"

To save 10 percent of the annual fuel bill

F. I. RAYMOND COMPANY

228 North La Salle St., Chicago, Ill.



Young Unit Heaters

Young Unit Heaters are introduced to Heating and Ventilating engineers as a perfected unit in which faults have been painstakingly eliminated. They are performing to the highest degree of satisfaction in major manufacturing plants. Young Unit Heaters "stand up", deliver more heat, retain their efficiency, and are guaranteed to be satisfactory in every way. We welcome your inquiry for full details of this new idea in Unit Heater construction.

YOUNG RADIATOR COMPANY

Heating Division

RACINE WISCONSIN

© Y.R. Co.

Young Quality

UNIT HEATERS
BUILT FOR ENDURANCE and MAXIMUM PERFORMANCE

Full Electric Motor of the MASTER Heat Regulator

It *Warns* as well as Regulates

NOT only does the Master Heat Regulator give users a new, higher standard of performance by *gradual* operation of dampers or valves.

It warns the householder of the condition of his fire by showing the position of valves or dampers at all times.

Used with coal, gas or oil— in any heating system or combination. Clock or plain models. Write for complete details.

White Mfg. Co.

2362 University Ave. ST. PAUL, MINN.

W-M-C Water Thermostats

For hot water heating systems—accurate, dependable and inexpensive. Easily installed without drawing the boiler or interfering with fire. Write for details.

MASTER HEAT REGULATOR

Announcing

Time-O-Stat Controls Company

A Consolidation of

LEACHWOOD COMPANY
Janesville, Wisconsin

TIME-O-STAT CORPORATION
Milwaukee, Wisconsin

ABSOLUTE CON-TAC-TOR CORPORATION
Elkhart, Indiana

CRAMBLET ENGINEERING CORPORATION
Milwaukee, Wisconsin

THE MERGING OF THESE FOUR COMPANIES will place at the services of its customers, and the industries which it serves, one consolidated company with ample resources and complete facilities for the development and manufacture of a very complete line of automatic controls.

IT WILL BE THE AIM OF THIS NEW COMPANY to maintain the reputation of making the finest and most dependable products of its kind, to hold the good will of its customers through the fairness of its policies and the service it renders, to sell its products at the lowest price consistent with the quality of the product and the service it renders.

THE COMPANY WILL HAVE A COMPLETE LINE OF AUTOMATIC CONTROLS for both domestic and industrial types of refrigeration and for heating with either oil, gas or coal. Also a very diversified line of controls and thermostats for gas, oil, electricity, etc., for time, pressure, humidity and temperature, sign flashers, heaters and other specialties.

IT WILL OWN MANY PATENTS including those covering the manufacture of (light and heavy duty) mercury switches and corrugated bellows. Manufacturing these products in its own plant will put the company in a very favorable position to not only improve its present products, but also carry on the development of new devices embodying such units.

TO ENABLE IT TO BETTER SERVE YOU general sales and service offices have been opened in the Peoples Gas Building, Chicago, and eastern offices will be opened in New York City The present sales and service organizations of the four companies will be consolidated and considerably increased.

BUILDING CONTRACTS WILL BE LET IMMEDIATELY to greatly enlarge the plant and offices at Elkhart, Indiana. A separate building will also be erected for laboratory, experimental and development work As soon as these buildings have been completed, the businesses of the three Wisconsin companies will be moved to Elkhart.

A LARGE STAFF OF ENGINEERS AND TECHNICIANS, each a specialist, will have ample facilities in the new laboratory for carrying on their work of constantly endeavoring to improve its products, develop new controls, and do experimental work for our customers.

THE OFFICERS OF THE COMPANY WILL BE President and Treasurer, Julius K. Luthe, Vice Presidents, A. I Wallace, Paul K. Cramblet, E. J Leach and Roy W Johnson.

NOTE Correspondence should be directed to each of the four companies, just as heretofore, until notice has been given that all the general offices have been consolidated and moved to Elkhart, Indiana.

No. 618 Sectional Peerless Steam Boiler.

The Intermediate Super Section of a No. 630 Peerless Boiler.

No. 624 Peerless Water Boiler with front section removed.

SAVING HEAT
for Customers
BUILDS
FUTURE SALES

To protect your business and build up good will in your customers, you should be certain that the heating plants you recommend are thoroughly efficient. It is always good policy to cooperate with consumers in keeping their fuel bills down.

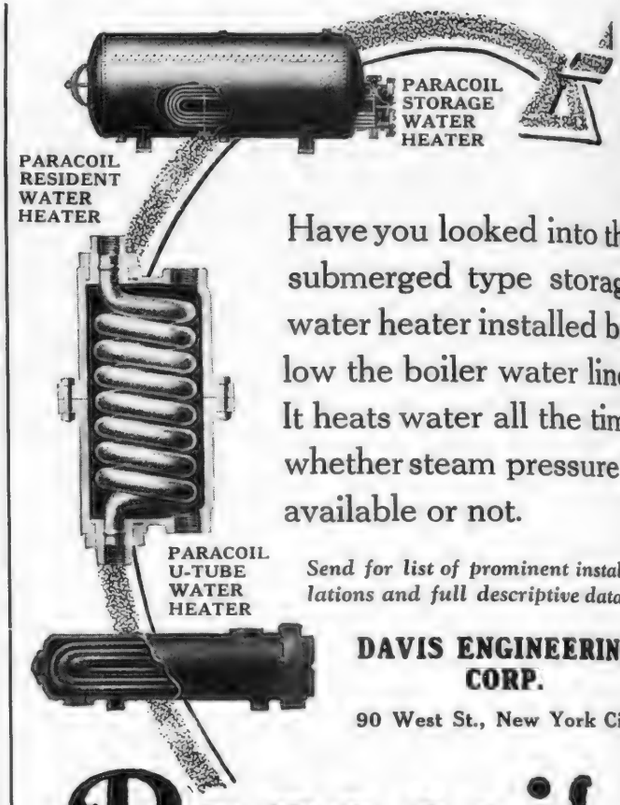
Peerless Super-Section Boilers are designed to "save heat" by saving the fuel. Unusually superior construction features, such as the design of the super section, the long 3-time fire travel, the elliptical shape and staggered arrangement of the water tubes, a V-shaped fire-box that prevents dead grate area make for outstanding efficiency. The unit construction of Peerless makes it adaptable to jobs of all sizes.

The No. 640 Peerless Super Section Water Boiler.

To sell a Peerless is to sell a new booster for your heating business. We can help you build a profitable boiler business on a basis of all around reliability.

Literature on request

THE PEERLESS HEATER COMPANY
Boyertown, Penna.



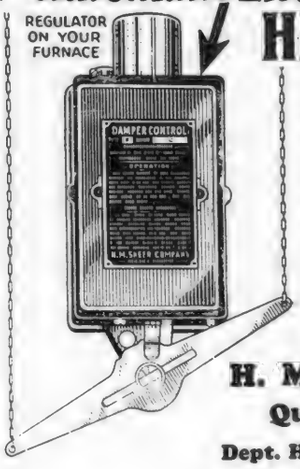
Have you looked into the submerged type storage water heater installed below the boiler water line? It heats water all the time whether steam pressure is available or not.

Send for list of prominent installations and full descriptive data.

DAVIS ENGINEERING CORP.
90 West St., New York City

Paracoil
WATER HEATERS

Cut Your Coal Bills
with
"SHEER COMFORT"
Automatic Electric HEAT CONTROL



Dealer's Price
Only $17.55

Write or Wire
H. M. SHEER CO.
Quincy, Illinois
Dept. H. V. Est. 1888

"We keep others in Hot Water"

SIMS

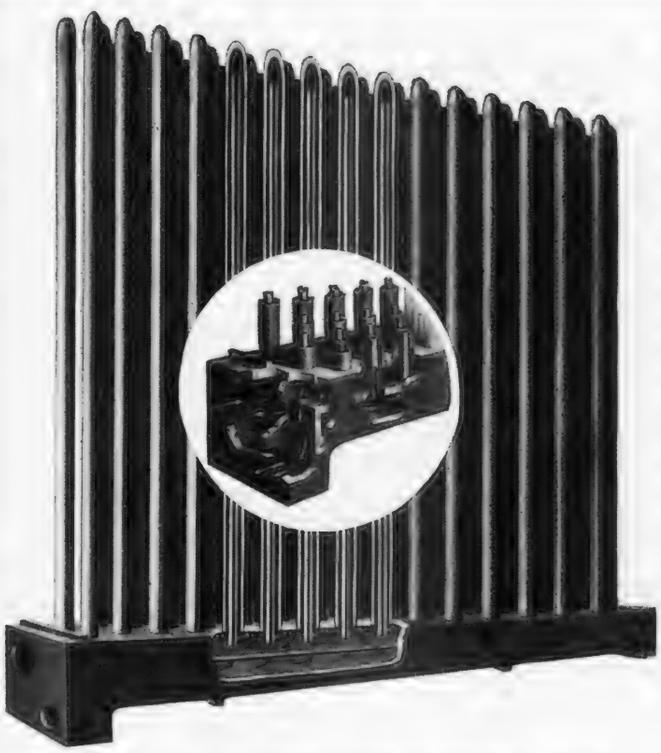
Storage type water heaters are furnished with "U" tubes as illustrated, or with straight tubes and floating head, as may be desired or specified.

SIMS

Water tube heaters and Converters are also constructed with either straight or "U" tubes.

All heaters are produced complete in our plant. They are not an assembly of parts built by others.

THE SIMS COMPANY, P. O. Box 700 Erie, Penna.



Inset shows enlarged cut-away section of manifold of Chinook Heater, illustrating tube-within-a-tube circulating principle. Steam enters manifold where arrows indicate, distributes three supply chamber sizes in ⅜-inch pipe, is condensed in 1¼-inch pipe radiator, returning by gravity to condensation chamber and leaving heater where arrows indicate.

Specify and Install "Chinook Heaters"

An improved form of Indirect Heaters, for use with heating, ventilating, and drying apparatus. Built on the "tube within a tube" principle, every tube a complete radiator in itself. Construction is such that there are no return bends, elbows and nipples. Permits use of steam at either high or low pressure. The design is such that every square foot of Chinook is prime heating surface.

Send for bulletin No. 24, describing Chinook Heaters and showing why they are most effective for heating, ventilating and drying systems.

BAYLEY BLOWER CO.

742 Greenbush St. MILWAUKEE, WIS.

Bayley

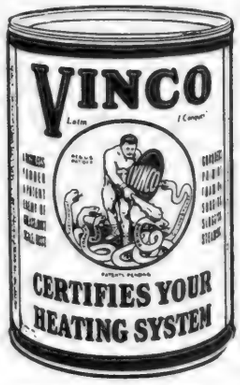
AIR ENGINEERING & EQUIPMENT

HEATING AND VENTILATING
AIR WASHING AND HUMIDIFYING SYSTEMS
MILL EXHAUSTERS—PRESSURE BLOWERS
MECHANICAL DRAFT FANS
AIR AND GAS SCRUBBERS
INDUSTRIAL DRYING SYSTEMS

When the water level drops from here to there while you watch

A NEW or remodeled steam or vapor heating system—design perfect and boiler plenty large—but even after blow down, the water level is still jumpy. You want to get your men away and onto profitable work, but you know the job can't be delivered until all foaming and priming are stopped.

Use *VINCO*
—Save your time, money and labor.



Leading manufacturers of heating equipment advise Vinco for all new, remodeled and old heating systems.

THE UNIQUE VINCO GUARANTEE

Not only is VINCO guaranteed on a money-back basis, but your *time and comfort* are also guaranteed by our free laboratory service which speeds the cure of your most complicated and difficult water line cases.
Boiler and heating specialty manufacturers, as well as other heating engineers, find this service a great help.
VINCO is distributed by leading jobbers everywhere.
For full information address: Vinco Co., Inc., P. O. Box 126, City Hall Station, N. Y. C.

VINCO CURES PRIMING - FOAMING - SURGING - SLUGGISH STEAMING
By absorbing and removing oil, grease, rust, scale, dirt

For safety and full benefits see that the material comes from 1½, 3, 5 and 10 lb. lithographed cans as illustrated.

A Dependable Hot Water Supply

Wainwright heaters that supply hot water in one of the leading New York hotels. Wainwright heaters are available in the vertical or horizontal types.

Wainwright heaters are built for any size project, hotels, apartments and hospitals.

Wainwright hot water heaters are built to meet any capacity requirements or temperature range. Either exhaust or live steam may be used for heating the water.

The Wainwright hot water heaters installed in one of the largest and most modern of New York hotels are shown in the accompanying illustration. Besides supplying the guests, kitchens, etc., the complete hotel laundry is furnished with hot water from these heaters.

The piping and valves are so arranged that the high, intermediate and low pressure heaters are interchangeable. This permits one heater handling the hot water supply to all floors in cases of emergency.

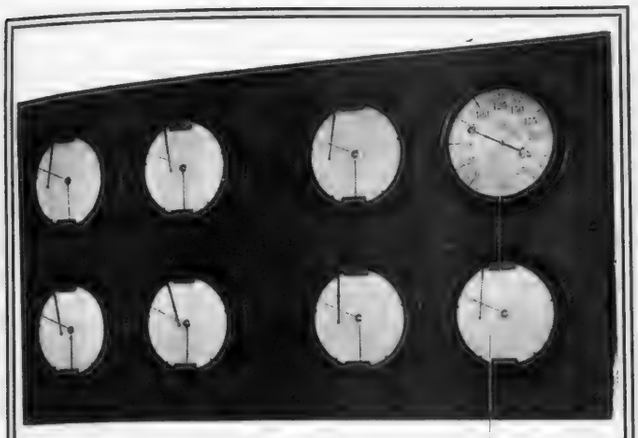
FOSTER WHEELER CORPORATION
165 Broadway, New York, N. Y.
Branches in Principal Cities

Foreign Associates:—
Foster Wheeler Limited; London, England.
Foster Wheeler Limited; Toronto-Montreal-Vancouver, Can.

AERO UNIT COAL PULVERIZERS
AIR HEATERS CENTRIFUGAL PUMPS
CONDENSERS COOLING TOWERS
ECONOMIZERS EVAPORATORS
EXPANSION JOINTS FEED WATER HEATERS

FOSTER WHEELER

FRACTIONATING TOWERS HEAT EXCHANGERS
STEAM JET AIR PUMPS SUPERHEATERS
TUBE STILLS VACUUM PUMPS
WATER COOLED FURNACE SURFACES
BRASS AND COPPER TUBING AND PIPE



Foxboro Instrument Board at Federal Reserve Bank, Boston.

"Shooting the Sun" in the Boiler Room

THE navigator must "shoot the sun" every day to determine his exact position. In the modern boiler room, the engineer determines his position by a glance at his Foxboro Instrument Board. Facts are centralized at a convenient point.

Each Instrument has its story to tell. The Foxboro Recording Thermometer on the boiler feed water, charts a complete and accurate record of the operation of the preheater and economizer. Comparison of charts points to any irregularity in operation. It is in this way your savings are made.

Foxboro Instruments are saving time and money in hundreds of buildings. A guarantee of permanent calibration is sealed to each Instrument. It is the tangible expression of the high quality of Foxboro Instruments. It is your protection. Let a Foxboro Engineer tell you more about them. Write the nearest Branch.

THE FOXBORO COMPANY

Neponset Avenue, Foxboro, Mass., U.S.A.

New York Chicago Philadelphia Boston Pittsburgh
Detroit Cleveland Tulsa Rochester, N. Y. Atlanta
San Francisco Dallas Los Angeles Portland, Ore.

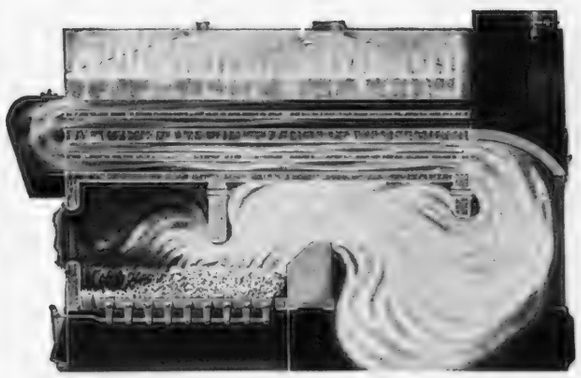
AUSTRALIA—Alfred Snashall, Ltd., Sydney & Melbourne.

FOXBORO

REG. U. S. PAT. OFF.

THE COMPASS OF INDUSTRY

Instruments for Controlling, Recording and Indicating Temperature, Flow, Humidity and Pressure.



Efficiency

Johnston Steel Heating Boilers give the maximum heat at a minimum fuel cost. The large combustion chamber, the heating surfaces of ample area to readily and fully absorb the heat created in the combustion chambers, the long gas travel affording the necessary time for the complete absorption of the heat of the gases, and the single body of water with its direct unrestricted circulating spaces provide for a quick delivery of the developed heat into useful work at the boiler outlets—these are some of the Johnston features that assure heating efficiency.

JOHNSTON STEEL HEATING BOILERS

Here are the outstanding points about Johnston Boilers

√ **1. Substantial construction**
√ **2. Efficient operation**
3. Simplicity of design
4. 60 years' boiler building experience
5. Built to A.S.M.E. standards
6. Fully guaranteed

JOHNSTON BROTHERS, Inc.

FERRYSBURG, MICHIGAN

JOHNSTON BROTHERS, INC.,
Ferrysburg, Michigan.

Gentlemen:

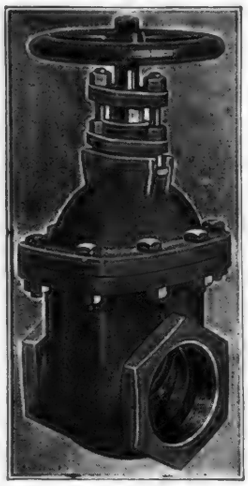
Send me a copy of your Bulletin illustrating and describing completely your Steel Heating Boilers.

Name.....

Address.....

City.....State.....

IRON BODY GATE VALVES



SCREWED, FLANGED
AND
HUB END STYLES

NON-RISING STEM
AND
O. S. and Y. PATTERNS

ALSO MANUFACTURERS OF
Cast and Malleable Iron Fittings

Illinois Malleable Iron Company

1801 Diversey Parkway :-: :-: Chicago, Ill.

HOT WATER—Millions of Gallons Each Day

WHITLOCK *Service Water* HEATERS

are silently doing their part in ministering to the comfort of the guests of hotels, the sick in hospitals, and those performing their daily work in the great office buildings. You can depend on Whitlock.

U. S. Bureau of Engraving and Printing
Hot Water supplied by a Whitlock Heater.

The Whitlock Coil Pipe Company
40 South Street :: :: Hartford, Conn.

New York Philadelphia Baltimore Los Angeles
Boston Chicago Detroit San Francisco
and other principal cities. Consult telephone book.

WHITLOCK
SERVICE WATER
HEATERS

PRICED RIGHT

A dollar's worth for every dollar you spend. That's what you get in Swartwout Steam Products. Ask for complete catalog.

THE SWARTWOUT COMPANY
18511 Euclid Avenue
Cleveland, Ohio

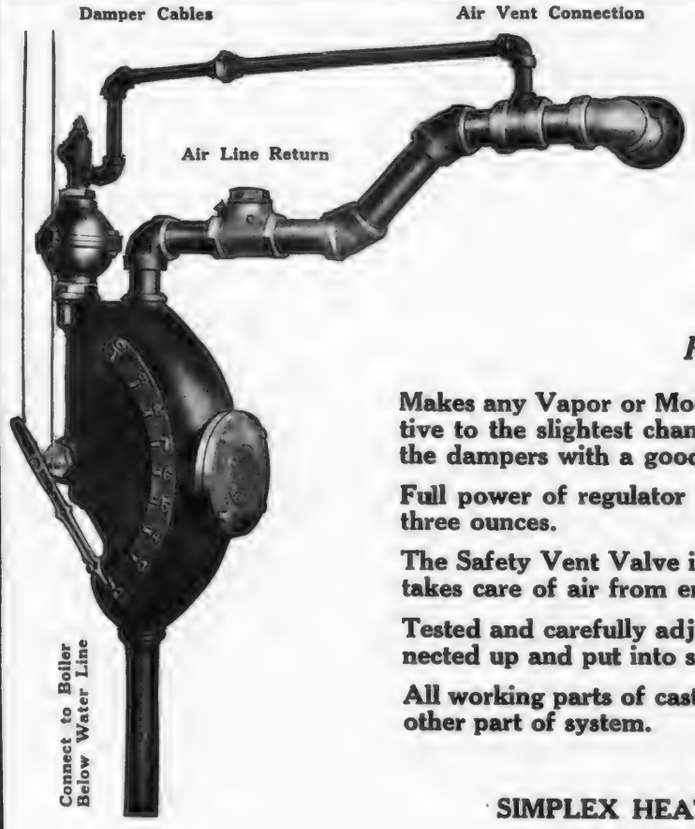
Swartwout
Steam Products

The **KAINER**
PRESSURE GOVERNOR

More and more plumbing and heating contractors are recommending and installing The Kainer Pressure Governor in place of expansion tanks and fittings on their hot water layouts. They have found that the moderate first cost, ease of installation, generous margin of profit and dependable performance spell prestige and profit for them.

Write us for full information

KAINER & COMPANY
CHICAGO
761-771 MATHER STREET
Manufacturers



Wiley

Safety-Vent Vapor Regulator

POWER IS ITS MIDDLE NAME

Makes any Vapor or Modulating System safe and satisfactory. Sensitive to the slightest change in pressure. Has ample power to control the dampers with a good working margin.

Full power of regulator is exerted within a pressure range of two or three ounces.

The Safety Vent Valve is a distinguishing feature of this regulator and takes care of air from entire heating system.

Tested and carefully adjusted before leaving factory, ready to be connected up and put into service, with the least trouble and expense.

All working parts of cast bronze. Will last as long as the boiler, or any other part of system.

Write for details

SIMPLEX HEATING SPECIALTY COMPANY, Inc.
LYNCHBURG, VA.

The ability of the Haines Trap to function year after year without the need of attention or repair is its best advertisement.

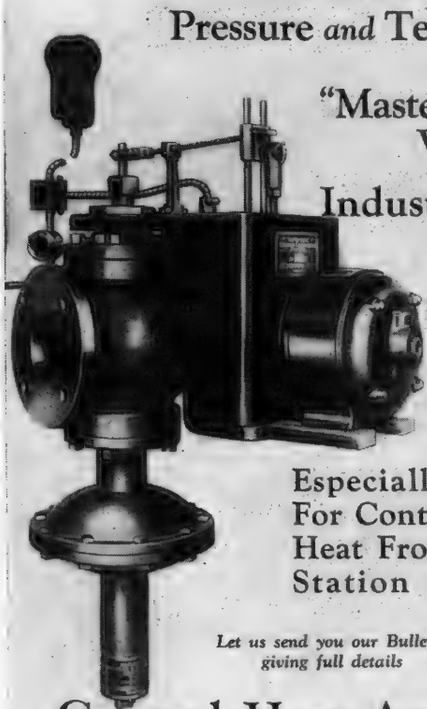
Haines Traps installed on every radiator and drip point

Is assurance of an economical and trouble-free system

Not a particle of steam gets away.
Nothing that ought to stay in gets out.
Nothing that ought to get out stays in.

WILLIAM S. HAINES & CO. 12th & Buttonwood Sts. PHILADELPHIA, PA.

HORNUNG
Pressure *and* Temperature
2 in 1
"Master Control" Valve
(PATENTED)
Industrial Type



Motor Operated Directly by Thermostat

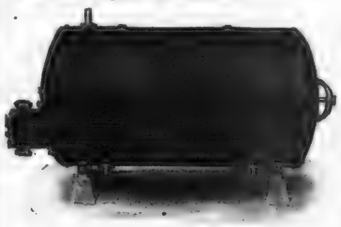
All Relays Eliminated ... .

Especially Designed For Control of Steam Heat From a Central Station

Let us send you our Bulletin giving full details

Central Heat Appliances
J. C. HORNUNG, *Engineer*
343 South Dearborn Street Chicago, Illinois
(3475)

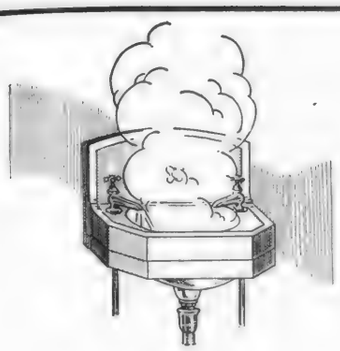
Alberger Buffalo Heaters
are built for a great variety of standard and special operating conditions for heating water with steam or for the interchange of heat from one liquid to another.



Instantaneous Heaters
Storage Heaters
Swimming Pool Heaters
Economizers
Coolers
Heat Interchangers

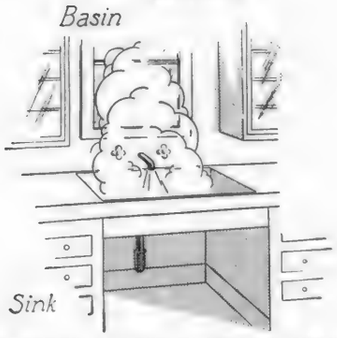
ALBERGER HEATER CO. 285 Chicago St.
HOWARD IRON WORKS Buffalo, N. Y.

See Pages
168 - 170 - 172 - 174
ENGINEERS' SPECIFICATION INDEX



Basin

Basin



Sink

America's largest copper boiler makers

Bath

ALWAYS—a plentiful supply of clean HOT WATER

The Dahlquist Super-Aquatherm is the last word in copper automatic storage units for the home and is made in sizes to meet all requirements.

The Dahlquist Mfg. Co. also produces a complete line of copper range boilers with or without heating units which are available with the famous Dahlquist Aquatherm, a patented device which greatly increases the efficiency of the unit—heating units using kerosene, gas, electricity or coal can be furnished.

For industrial uses Dahlquist's tremendous facilities make possible the production of copper boilers of any capacity and America's leading architects and engineers specify Dahlquist boilers for the largest buildings.

Write for illustrated literature describing Dahlquist hot water copper boilers. Dahlquist uses only Anaconda Copper.

DAHLQUIST MANUFACTURING COMPANY, A. 2nd & West 3rd Streets SOUTH BOSTON, MASS.

FULL LINE All Latest Features

BROWNELL BOILERS have been on the market 73 years, and are sold all over the world. Full line, all latest features.

BROWNELL AUTOMATIC UNDERFEED STOKERS will save from 15 to 50% on fuel bills and firing expense. Will improve combustion by utilizing the heat units in the coal and gases that escape as smoke when you fire by hand. Will deliver hotter fire on LOWER GRADES OF COAL AND LESS OF IT.

Stop wasteful hand-firing. Install a BROWNELL AUTOMATIC UNDERFEED.

A representative near you.

Get ASME Code Boiler Bulletin B-6-A.

Get Underfeed Stoker Bulletin S-50.

The Brownell Company
Dayton, O. U. S. A.

BROWNELL
Boilers and Stokers

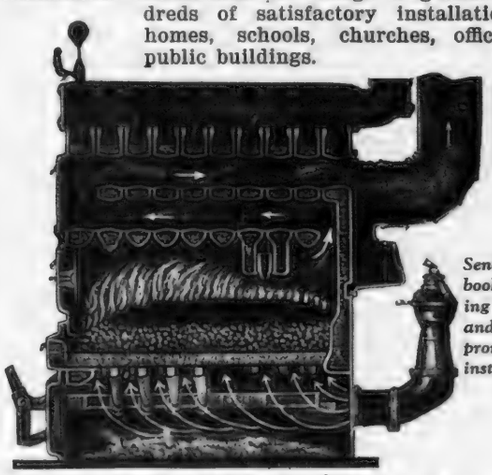
See our exhibit at the Midwestern Engineering Exposition—Booths 169 and 170, Chicago, Feb. 12th to 16th.

MORE HEAT PER TON OF COAL

WITH THE REGISTERED COPPUS U.S. PAT. OFFICE

UNDER-GRATE DRAFT BLOWER

The COPPUS is a scientifically constructed, coal burning blower designed to burn any grade of coal. Its installation necessitates no change in grates. Hundreds of satisfactory installations in homes, schools, churches, office and public buildings.



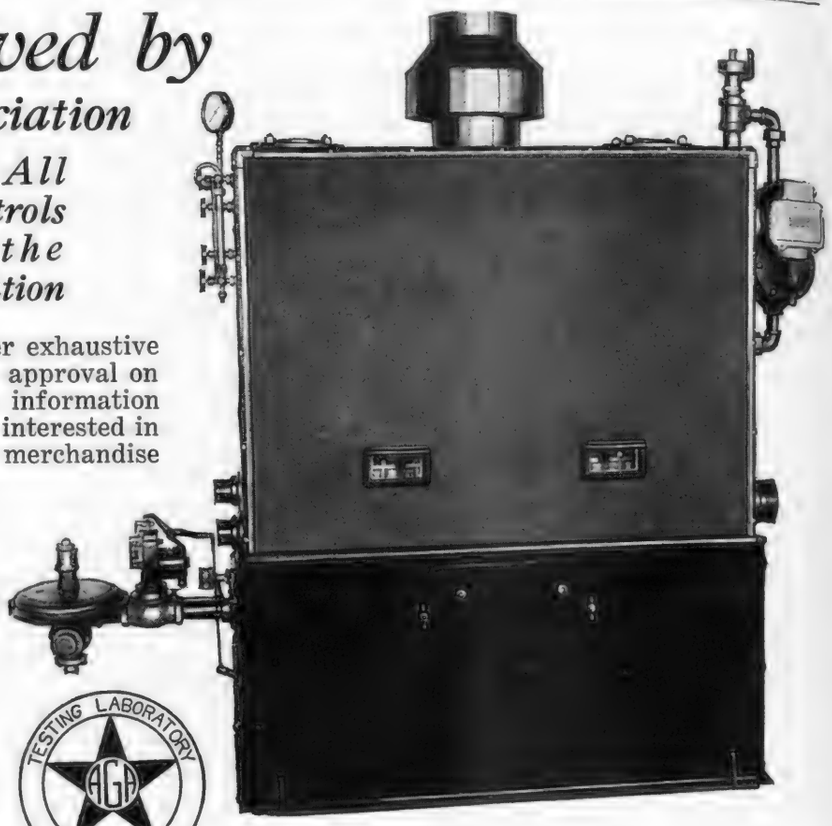
Send for booklet giving details and list of prominent installations

INTERNATIONAL FUEL SERVICE CORP.
Sole Distributors in the United States and Canada
BRIDGEPORT, CONN.

Now! Approved by

American Gas Association

Is Equipped With All Automatic Safety Controls as Required by the American Gas Association



The American Gas Association, after exhaustive tests, has placed its official stamp of approval on the Bryan Steam Gas Boiler. This information will be of interest to dealers who are interested in selling the most modern and efficient merchandise to their customers.

Bryan Gas Boilers are ultra modern, highly efficient, and very economical. The Bryan plan of dealer co-operation offers an opportunity to alert dealers to cash in on the ever-increasing trend toward gas heating.

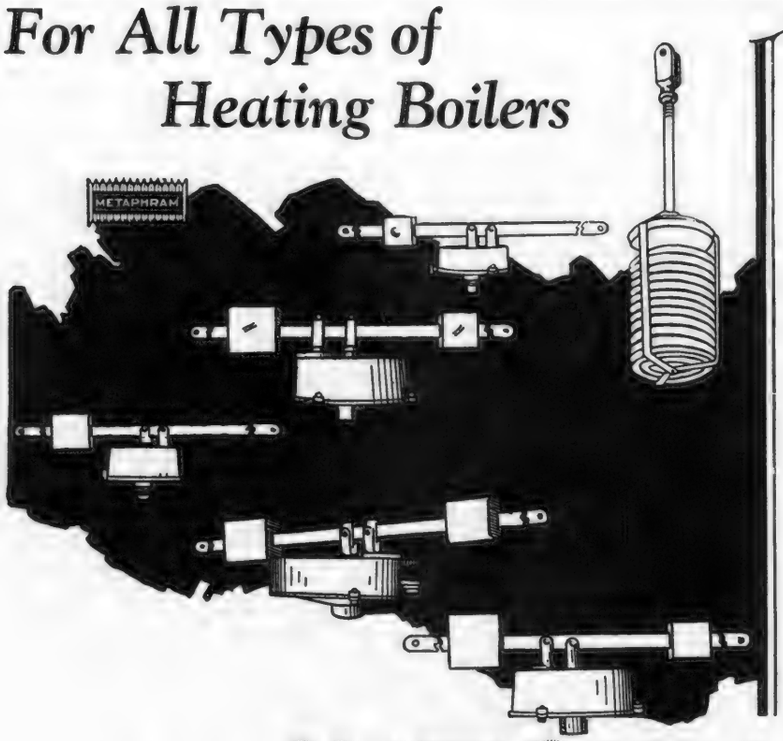
TESTING LABORATORY A.G.A. APPROVED

Write us today for full information.

BRYAN STEAM CORPORATION

PERU BOILER DIVISION IND.

For All Types of Heating Boilers



THERE is a METAPHRAM Damper Regulator to fit every type and size of heating boiler.

They range in size from the 2-inch "Type F" for hot water boilers and domestic water heaters to the 10-inch "Type D" for large heating boilers operating on either pressure, vapor or vacuum.

They all employ the same principle of patented METAPHRAM construction—separable, metal diaphragms, extremely sensitive to slight changes in pressure or temperature, and extremely powerful.

In fact, METAPHRAM Damper Regulators deliver more *power* to the operating lever than any other regulator, which is one reason why they are so much preferred by many leading boiler manufacturers and contractors.

Descriptive literature will be sent on request.

National Regulator Co.
2317 N. Knox Ave., Chicago, Ill.

NATIONAL METAPHRAM DAMPER REGULATOR

Specialists in District Heating

Equipment for Underground Steam Lines

ADSCO EXTERNALLY-GUIDED EXPANSION JOINT

For 4, 6, 8, 10 and 12" traverse, 125 and 250 lbs. pressure. Checks distortion. Assures correct alignment of the slip. Provides a secure anchorage and a service outlet.

The makers of Singer Sewing Machines know how to choose Expansion Joints

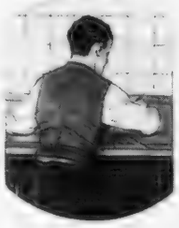
Like other nationally and internationally famous users of ADSCO Expansion Joints, the Singer Manufacturing Company gave serious consideration to strength of construction, efficient operation and maintenance costs in choosing equipment for their pipe lines.

In their investigation of ADSCO Expansion Joints this is what they undoubtedly learned:

ADSCO Expansion Joints are the products of fifty years of constant improvement and are used on 90% of the country's great District Heating installations. Many of these long-lived expansion devices have been buried underground for fifteen to twenty years ... and longer ... have never been examined during these periods ... and still are giving perfect service.

They found out, too, that ADSCO Expansion Joints are available in a complete range of designs for conveying steam, hot-water, air, gas and other liquids. They can be had in all sizes, with 2 to 12 inch traverse, and in weights for varying pressures. The correct type for every requirement is available in the ADSCO line.

The Singer Company chose wisely on expansion joints—in fact, on any equipment used in the installation of District Heating or other pipe lines, it will pay you, too, to investigate ADSCO Specialties and ADSCO Service.



ADSCO Engineers at Your Service

The ADSCO Engineering Department will gladly lend its many years of experience to the working out of any problem you may have in pipe line equipment and construction. Make use of it.

AMERICAN DISTRICT STEAM COMPANY

NORTH TONAWANDA, N.Y.

to be sure of getting

ADSCO

EXPANSION JOINTS

Order Direct

The First Step is to get this BOOK

AMERICAN DISTRICT STEAM COMPANY
NORTH TONAWANDA, N.Y.

Please send me free your new book "Reference Data on Expansion in Pipe Lines."

Name.....

Position.....

Company.....

Address..... H.V.-1

Twinfan Small Unit

for 200 to 1000 square feet of radiation

THE NEW TYPE "V"

TWINFAN

UNIT HEATER

New Type "V" installation in a greasing station.

All the standards which have made the reputation of Twinfan Unit heaters in the large sizes are retained in the new Type "V" for heating small spaces.

Write for descriptive bulletins containing accurate capacity and efficiency tables.

Standard Twinfan installation showing suspension from ceiling, and also floor stand type.

DWYER EQUIPMENT CO.
4534 W. NORTH AVE. CHICAGO, ILL.
HEAT WITH TWINFAN UNIT HEATERS

For 20 Years

Knowles Mushrooms Have Blazed the Trail

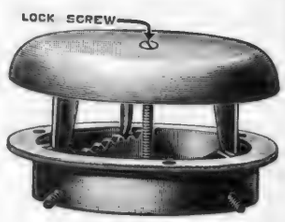
We made the first AIR DIFFUSER for auditorium ventilation—which is still giving satisfactory service.

And we have been leading the way in improved design ever since, as is proven by our NU-NOTCH MUSHROOM, DISC-LOC GALLERY RISER VENT and AERO-VALVE AIR DIFFUSER which are chosen for their exclusive features and low cost.

Nu-Notch
REG U S PAT OFF
MUSHROOM VENTILATOR

NU-NOTCH is Simple, Rigid and Easily adjusted in recessed notches. For any kind of floor. Also *flat tops* for low seats, and steel ring for sleeve.

KNOWLES MUSHROOM VENTILATOR CO.
202 Franklin St., N. Y. City

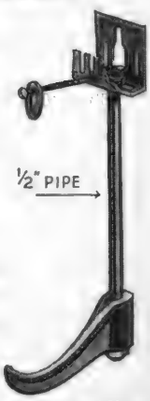


Pat. Aug. 7, 1928

No Hiding Place For Dust and Germs

Every housewife and caretaker hail the wall hung legless radiator as one of the greatest improvements since radiators came into use.

Clean! Better looking! Floors unspoiled by hot radiator legs!



The Modern Way— Most Convenient

is the hanging of radiators with E-Z Hangers. No need for accurate measurements of anchor bolts. Height and lateral variations taken care of. Hanger is out of sight. 2 x 4 studding holds it. Adapted to any wall material. Recommended everywhere by leading architects and contractors. In wide use in homes, office buildings, hospitals, schools and public buildings. Large stocks in all principal cities. Get all the facts on advantages of

E-Z RADIATOR HANGER

HEALY-RUFF COMPANY
784 Hampden Ave., St. Paul, Minn.
Also Manufacturers of E-Z Inserts

Truck Weighed 23,175 pounds It was driven 10 M.P.H. It hit the "back-fill" 325 times

But the Ric-wiL Tile Conduit underneath was unharmed!

Will Ric-wiL Conduit of vitrified tile stand up under the punishment of earth-load and heavy traffic?

We wanted the answer—a positive answer that would settle the matter finally.

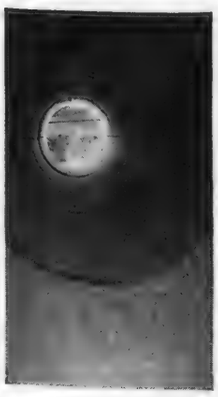
We got it. Ric-wiL stood up under a test that was many times as severe as the worst conditions it will ever be called on to meet.

This photograph shows the 23,175 pounds of truck and gravel pounding across the filled-in trench.

Five sections of 15" Ric-wiL Conduit were installed in a 33" wide trench on Ric-wiL Base Drain Foundation. Back-fill of 2½' over top of conduit was tamped with a 4000-pound truck running over it 200 times. Then we loaded a 5-ton truck with gravel—gross weight 23,175 pounds. It was driven 325 times across the trench at a speed of 10 miles per hour—325 gigantic blows that grew heavier and heavier as the back-fill packed.

But when we dug up the Ric-wiL, there wasn't even a crack in it. Not even the joints were disturbed. We'll send you full details of this test if you want them.

Another advantage for you when you put underground steam lines in Ric-wiL—dependable strength that guarantees permanent water-tightness. Add that to Ric-wiL extraordinary speed and economy of installation and it's well above 90% efficiency and you explain why miles more Ric-wiL than ever before were put in for important buyers last year.



Photograph through the conduit installed for the test, the interior whitewashed so cracks would show up clearly. But there wasn't a crack.

For profit's sake, get the Ric-wiL proposal on your next job.

The Ric-wiL Company
1567 Union Trust Bldg., Cleveland, Ohio
Offices in Principal Cities

Originators *of* Waterproof Conduit Filler

RicwiL

UNDERGROUND CONDUIT

NATIONAL
Storage U BEND TYPE Heater

Three Reasons why NATIONAL SOLID COPPER Storage Heaters are growing in use

1st. Low cost of operation.
No repairs or replacements.

2nd. Initial Cost Reasonable.
Compare most favorably with other types of Heaters that are not all solid copper.

3rd. Guarantee Clean Water.
A most practical type of heater to use in a building with brass or copper piping. No rusty water. An all copper —all brass job.

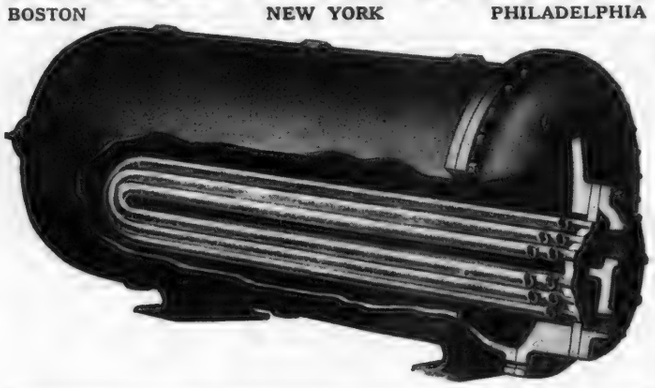
Well constructed apartment houses, hotels, clubs, etc. now being erected, are using National Solid Copper Heaters. These owners are profiting by the experience of others who are entirely satisfied with the operation and pleased with the economy of the National.

Plan now on a National Solid Copper Heater for your next installation. Here are the specifications:

Solid Copper shell fabricated in accordance with Standard Boiler Practice, and made of pure electrolytic copper.
Heavy Copper tubes, seamless drawn, of heavier gauge than ordinarily used.
Cast Bronze Tube Plate also bronze tappings and supports. All parts coming in contact with the water are of non-ferrous metal.

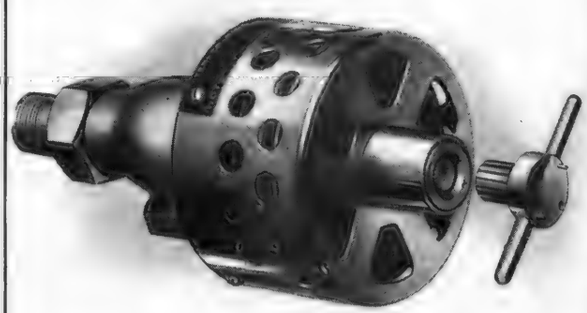
Write for quotations on the Solid Copper Heater

The National Pipe Bending Co.
120 River Street *Established 1883* **New Haven, Conn.**
BOSTON NEW YORK PHILADELPHIA



Announcing A New Feature

The Sterlco Roys Thermotrol *now made with* Loose Key Handle



Thermotrols attached *directly to radiators* will give efficient temperature regulation. Being self-contained, they are individually controlled and operated. No compressed air tubing or electrical connections required.

For Public Building work the *Loose Key* Thermotrol is ideal, in that the operating point can be determined by the engineer in charge and the setting cannot be tampered with.

Write for Bulletin No. 40.

STERLING ENGINEERING CO.
1640 Holton Street
Milwaukee, Wis.

Agencies located in principal cities

Nugent Crank Case Fuel Oil Filter

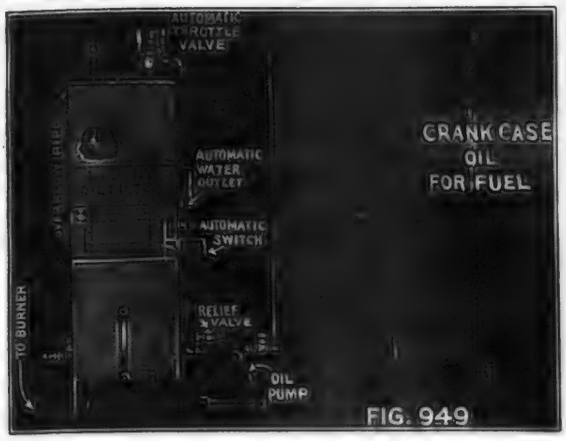


FIG. 949

HEAT YOUR BUILDING WITHOUT COST
BY BURNING DISCARDED CRANK CASE OIL
NO MORE BURNER TROUBLE

Write for catalog

WM. W. NUGENT & COMPANY
409 N. Hermitage Ave., Chicago, U. S. A.

Builders since 1897 of
Oiling Systems — Oiling Devices
Oil Filters — Oil Pumps

Read this Letter

MONARCH GARAGE
1122-1130 HOLLYWOOD AVENUE AT THE L
CHICAGO, ILL.

NUGENT TRADE MARK

Easy to install.

Just break the Oil Burner Suction Pipe and set it in.

They are shipped all assembled ready for use.

Only two connections to make.

Wm. W. Nugent & Co. December 19,1927.
Chicago,Ill.

Gentlemen:-

About a year and a half ago we purchased from you a Nugent Oil Filter and motor driven oil pump to filter automobile crank case oil for our oil burner.

This purchase has been one of the best investments we ever made, because the apparatus paid for itself in less than three months. We operate our burner on the filtered crank case oil entirely, consequently we have no fuel bills.

The filter removes the water, dirt, grit, and carbon from the oil so efficiently that the fine mesh strainer at the burner never has to be cleaned, and the burner operates perfectly.

Cleaning the filter requires only ten minutes twice a week and there is no other upkeep to the filter, as the filtering elements will last for years without renewing.

We are very pleased with the filter and pump as well as the service you have given us. We highly recommend your apparatus to anyone.

Very truly yours,

MONARCH GARAGE
BY E. E. [illegible]

POWERFUL, STURDY, QUIET, DEPENDABLE

Year After Year

Year after year these powerful exhaust fans will handle your problems of heat, steam, gas and odor removal with a mimimum of attention.

Frame, supporting ring, blades and motor are engineered and built "to last." Vibration is negligible. Available in 12, 16, 18, 24, 30, 36″ sizes —all are exceptionally quiet with large air removal capacity.

Automatic aluminum leaf shutters to fit all sizes. Convenient jobbing and warehouse stocks. Write for bulletin containing full information.

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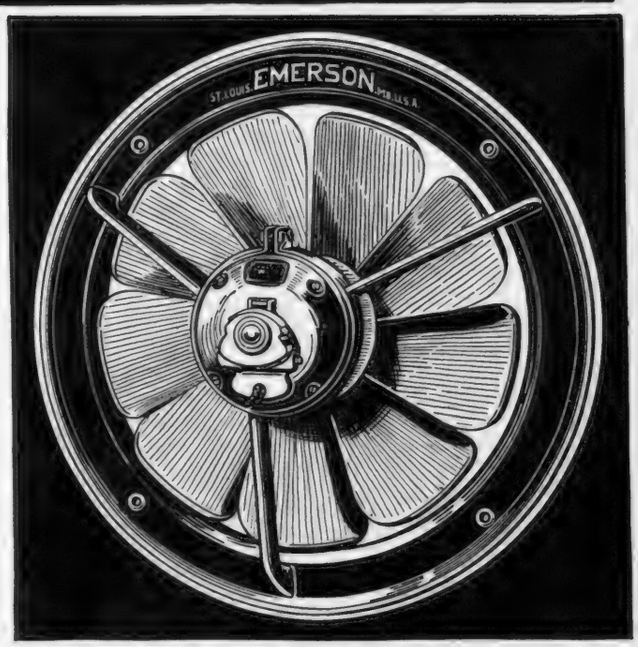
Made by the makers of Emerson Motors 1/30 to 2 H.P. A.C. and D.C.



EMERSON
EXHAUST FANS

ENGINEERS' SPECIFICATION INDEX

ACID FUME EXHAUSTERS
Duriron Company, Inc., The, Dayton, O.

AIR COMPRESSORS
American Steam Pump Co., Battle Creek, Mich.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Economy Pumping Machinery Co., Chicago, Ill.
Janette Mfg. Co., Chicago, Ill.
Johnson Service Co., Milwaukee, Wis.
Nash Engineering Co., So. Norwalk, Conn.
Powers Regulator Co., Chicago, Ill.

AIR CONDITIONING APPARATUS
American Blower Co., Detroit, Mich.
Bayley Blower Co., Milwaukee, Wis.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Carrier Engineering Corp., Newark, N. J.
Clarage Fan Co., Kalamazoo, Mich.
Connor Co., Inc., The W. B., New York.
General Air Filters Corp., New York.
Grinnell Co., Providence, R. I.
Johnson Service Co., Milwaukee, Wis.
National Air Filter Co., Chicago, Ill.
New York Blower Co., Chicago, Ill.
Skinner Bros. Mfg. Co., St. Louis, Mo.
St. Louis Blow Pipe & Heater Co., Inc., St. Louis, Mo.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Thermal Units Co., Chicago, Ill.
Vilter Mfg. Co., Milwaukee, Wis.
York Heating & Ventilating Corp., Phila., Pa.

AIR COOLING & DRYING SYSTEMS
American Blower Co., Detroit, Mich.
Badger & Sons Co., E. B., Boston, Mass.
Bayley Blower Co., Milwaukee, Wis.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Buffalo Forge Co., Buffalo, N. Y.
Carrier Engineering Corp., Newark, N. J.
Clarage Fan Co., Kalamazoo, Mich.
Connor Co., Inc., The W. B., New York.
General Air Filters Corp., New York.
Ilg Electric Ventilating Co., Chicago, Ill.
Johnson Service Co., Milwaukee, Wis.
National Air Filter Co., Chicago, Ill.
New York Blower Co., Chicago, Ill.
Skinner Bros. Mfg. Co., St. Louis, Mo.
St. Louis Blow Pipe & Heater Co., Inc., St. Louis, Mo.
Sturtevant Co., B. F., Hyde Park, Boston, Mass
Thermal Units Co., Chicago, Ill.

AIR ELIMINATORS
American District Steam Co., North Tonawanda, N. Y.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Cashin Co., W. D., Boston, Mass.
Dunham Co., C. A., Chicago, Ill.
Gorton Heating Corporation, New York.
Hoffman Specialty Co., New York.
Marsh & Co., Jas. P., Chicago, Ill.
Sarco Co., Inc., New York.
Sterling Engineering Co., Milwaukee, Wis.
Trane Co., The, LaCrosse, Wis.

AIR FILTERS
American Blower Co., Detroit, Mich.
Connor Co., Inc., The W. B., New York.
DeBothezat Impeller Co., Inc., New York
General Air Filters Corp., New York.
National Air Filter Co., Chicago, Ill.
Reed Air Filter Co., Inc., Louisville, Ky.
Staynew Filter Corp., Rochester. N. Y.

AIR SEPARATORS
Bishop & Babcock Sales Co., Cleveland, Ohio.
Swartwout Co., Cleveland, Ohio.

AIR WASHERS
American Blower Co., Detroit, Mich.
Badger & Sons Co., E. B., Boston, Mass.
Bayley Blower Co., Milwaukee, Wis.
Bishop & Babcock Sales Co., Cleveland Ohio.
Buffalo Forge Co., Buffalo, N. Y.
Carrier Engineering Corp., Newark, N. J.
Clarage Fan Co., Kalamazoo, Mich.
Connor Co., Inc., The W. B., New York.
General Air Filters Corp., New York
New York Blower Co., Chicago, Ill.

BELTING
Alexander Bros., Inc., Philadelphia, Pa.

BLOWERS, FAN
(See Fans, Supply & Exhaust).

BLOWERS, PRESSURE
American Blower Co., Detroit, Mich.
Bayley Blower Co., Milwaukee, Wis.
Buffalo Forge Co., Buffalo, N. Y.
Clarage Fan Co., Kalamazoo, Mich.
DeBothezat Impeller Co., Inc New York
Ilg Electric Ventilating Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Wing Mfg. Co., L. J., New York.

BLOWERS, ROTARY
Wing Mfg. Co., L. J., New York.

BLOWERS, TURBINE
Buffalo Forge Co., Buffalo, N. Y.
Wing Mfg. Co., L. J., New York.

BOILER CEMENT
Banner Rock Products Co., Alexandria, Ind.

BOILER COMPOUNDS
Vinco Co., Inc., New York.

BOILERS, DOWN-DRAFT
American Radiator Co., Buffalo, N. Y.
Brownell Co., The, Dayton, Ohio.
Fitzgibbons Boiler Co., Inc., New York.
Kewanee Boiler Corp., Kewanee, Ill.
National Radiator Corp., Johnstown, Pa.
Pacific Steel Boilers Corp., Waukegan, Ill.
Page Boiler Co., Wm. H., New York.
Stanwood Corporation, Cincinnati, Ohio.

BOILERS, GAS-FIRED
American Gas Products Corp., New York.
American Radiator Co., Buffalo, N. Y.
Eclipse Fuel Engineering Co., Rockford, Ill.
Frost Mfg. Co., Galesburg, Ill.
National Radiator Corp., Johnstown, Pa.
Stanwood Corporation, Cincinnati, Ohio.

BOILERS, HEATING
American Radiator Co., Buffalo, N. Y.
Brownell Co., The, Dayton, Ohio.
Bryan Steam Corp., Peru, Ind.
Burnham Boiler Corp., Irvington, N. Y.
Coatesville Boiler Works, Coatesville, Pa.
Combination Boiler Co., Benton Harbor, Mich.
Fitzgibbons Boiler Co., Inc., New York.
Frost Mfg. Co., Galesburg, Ill.
Gorton Heating Corporation, New York.
Heggie-Simplex Boiler Co., Joliet, Ill.
Illinois Malleable Iron Co., Chicago, Ill.
Johnston Brothers, Inc., Ferrysburg, Mich.
Kewanee Boiler Corp., Kewanee, Ill.
Monitor Boiler Co., Philadelphia, Pa.
National Radiator Corp., Johnstown, Pa.
Newport Boiler Co., Chicago, Ill.
Pacific Steel Boilers Corp., Waukegan, Ill.
Page Boiler Co., Wm. H., New York.
Peerless Heater Co., Boyertown, Pa.
Pierce, Butler & Pierce Mfg. Corp., New York.
Spencer Heater Co., Williamsport, Pa.
Stanwood Corporation, Cincinnati, Ohio.
Weil-McLain Co., Chicago, Ill.

BOILERS, MAGAZINE FEED
Gorton Heating Corporation, New York.
Newport Boiler Co., Chicago, Ill.
Spencer Heater Co., Williamsport, Pa.

BOILERS, OIL-FIRED
Bryan Steam Corp., Peru, Ind.
Combination Boiler Co., Benton Harbor, Mich.
Johnston Brothers, Inc., Ferrysburg, Mich.

BOILERS, POWER
Eclipse Fuel Engineering Co., Rockford, Ill.
Fitzgibbons Boiler Co., Inc., New York.
Frost Mfg. Co., Galesburg, Ill.
Heggie-Simplex Boiler Co., Joliet, Ill.
Kewanee Boiler Corp., Kewanee, Ill.
Pierce, Butler & Pierce Mfg. Corp., New York.
Stanwood Corporation, Cincinnati, Ohio.

CALORIMETERS
American Schaeffer & Budenberg Div., Consolidated Ashcroft Hancock Co., Inc., Brooklyn, N. Y.

CIRCULATORS, WATER
Janette Mfg. Co., Chicago, Ill.

COILS, PIPE
Bayley Blower Co., Milwaukee, Wis.
Buffalo Forge Co., Buffalo, N. Y.
Crane Co., Chicago, Ill.
Foster Wheeler Corporation, New York.
National Pipe Bending Co., New Haven, Conn.
Walworth Co., New York
Whitlock Coil Pipe Co., Hartford, Conn.

CONDENSERS
Davis Engineering Corp., New York.
Foster Wheeler Corporation, New York.
Frank Heater & Engineering Co., O. E., Buffalo, N. Y.
National Pipe Bending Co., New Haven, Conn.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Schutte & Koerting Co., Philadelphia, Pa.
Whitlock Coil Pipe Co., Hartford, Conn.

CONVERTERS, HOT WATER
Davis Engineering Corp., New York.
Frank Heater & Engineering Co., O. E., Buffalo, N. Y.
National Pipe Bending Co., New Haven, Conn.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Whitlock Coil Pipe Co., Hartford, Conn.

COOLERS, AIR
Alberger Heater Co., Buffalo, N. Y.
Frank Heater & Engineering Co., O. E., Buffalo, N. Y.

COOLERS, OIL
Davis Engineering Corp., New York.
National Pipe Bending Co., New Haven, Conn.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Schutte & Koerting Co., Philadelphia, Pa.
Spray Engineering Co., Boston, Mass.
Whitlock Coil Pipe Co., Hartford, Conn.

COOLING TOWERS & PONDS
Badger & Sons Co., E. B., Boston, Mass.
Buffalo Forge Co., Buffalo, N. Y.
Connor Co., Inc., The W. B., New York.
Foster Wheeler Corporation, New York.
General Air Filters Corp., New York.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Schutte & Koerting Co., Philadelphia, Pa.

COPPER BOILERS
Badger & Sons Co., E. B., Boston, Mass.

COPPER KETTLES
Badger & Sons Co., E. B., Boston, Mass.

COVERING, BOILER, PIPE, ETC.
American District Steam Co., North Tonawanda, N. Y.
Banner Rock Products Co., Alexandria, Ind.
Crane Co., Chicago, Ill.
Ric-wiL Co., The, Cleveland, Ohio.

DAMPERS, DUCT
Buckeye Blower Co., The, Columbus, Ohio.
Clarage Fan Co., Kalamazoo, Mich.

DEHUMIDIFYING APPARATUS
American Blower Co., Detroit, Mich.
Bayley Blower Co., Milwaukee, Wis.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Buffalo Forge Co., Buffalo, N. Y.
Carrier Engineering Corp., Newark, N. J.
Clarage Fan Co., Kalamazoo, Mich.
Connor Co., Inc., The W. B., New York.
General Air Filters Corp., New York.
Johnson Service Co., Milwaukee, Wis.
New York Blower Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Wing Mfg. Co., L. J., New York.
York Heating & Ventilating Corp., Phila., Pa.

DISTILLERS, (WATER)
Badger & Sons Co., E. B., Boston, Mass.
Davis Engineering Corp., New York.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Schutte & Koerting Co., Philadelphia, Pa.

DRAFT APPLIANCES
International Fuel Service Corp., Bridgeport, Conn.

DRYING SYSTEMS
(See Air Cooling & Drying Systems).

DUST COLLECTING SYSTEMS
American Blower Co., Detroit, Mich.
Bayley Blower Co., Milwaukee, Wis.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Buffalo Forge Co., Buffalo, N. Y.
Clarage Fan Co., Kalamazoo, Mich.
Connor Co., Inc., The W. B., New York.
General Air Filters Corp., New York.
Reed Air Filter Co., Inc., Louisville, Ky.
Skinner Bros. Mfg. Co., St. Louis, Mo.
St. Louis Blow Pipe & Heater Co., Inc., St. Louis, Mo.

DUST COLLECTORS
American Blower Co., Detroit, Mich.
Buffalo Forge Co., Buffalo, N. Y.
Carrier Engineering Corp., Newark, N. J.
Connor Co., Inc., The W. B., New York.
General Air Filters Corp., New York.
Skinner Bros. Mfg. Co., St. Louis, Mo.
St. Louis Blow Pipe & Heater Co., Inc., St. Louis, Mo.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
York Heating & Ventilating Corp., Phila., Pa.

ENGINES, STEAM, AUTOMATIC
American Blower Co., Detroit, Mich.
Brownell Co., The, Dayton, Ohio.
Clarage Fan Co., Kalamazoo, Mich.
Frost Mfg. Co., Galesburg, Ill.
Pierce, Butler & Pierce Mfg. Corp., New York.
Stanwood Corporation, Cincinnati, Ohio.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

ENGINES, STEAM, HIGH SPEED
American Blower Co., Detroit, Mich.
Brownell Co., The, Dayton, Ohio.
Clarage Fan Co., Kalamazoo, Mich.
Frost Mfg. Co., Galesburg, Ill.
Pierce, Butler & Pierce Mfg. Corp., New York.
Stanwood Corporation, Cincinnati, Ohio.

EQUALIZING LOOPS
Hoffman Specialty Co., New York.
Sarco Co., Inc., New York.

EVAPORATORS, BOILER FEED MAKE-UP
Buffalo Forge Co., Buffalo, N. Y.
Davis Engineering Corp., New York
Foster Wheeler Corporation, New York.
National Pipe Bending Co., New Haven, Conn.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Schutte & Koerting Co., Philadelphia, Pa.

EXHAUST HEADS
Aeolus Dickinson, Chicago, Ill.
Crane Co., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Kieley & Mueller, Inc., New York.
McAlear Mfg. Co., Chicago, Ill.
Skinner Bros. Mfg. Co., St. Louis, Mo.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Swartwout Co., Cleveland, Ohio.

EXHAUST SYSTEMS
American Blower Co., Detroit, Mich.
Autovent Fan & Blower Co., Chicago, Ill.
Bayley Blower Co., Milwaukee, Wis.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Buffalo Forge Co., Buffalo, N. Y.
Clarage Fan Co., Kalamazoo, Mich.
Ilg Electric Ventilating Co., Chicago, Ill.
Skinner Bros. Mfg. Co., St. Louis, Mo.
St. Louis Blow Pipe & Heater Co., Inc., St. Louis, Mo.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Wing Mfg. Co., L. J., New York.

EXHAUST SYSTEMS, ACID
Duriron Company, Inc., The, Dayton, O.

EXPANSION JOINTS
Alberger Heater Co., Buffalo, N. Y.
American District Steam Co., North Tonawanda, N. Y.
Badger & Sons Co., E. B., Boston, Mass.
Central Station Steam Co., Detroit, Mich.
Crane Co., Chicago, Ill.
Foster Wheeler Corporation, New York.
Fulton Syphon Co., Knoxville, Tenn
Hornung, J. C., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill
Ross Heater & Mfg. Co., Buffalo, N. Y
Walworth Co., New York
Webster & Co., Warren, Camden, N. J

EXPANSION SHELLS
Phillips Drill Co., Chicago, Ill.

FANS, ACID RESISTING
Duriron Company, Inc., The, Dayton, O.

FANS, DISC PRESSURE
DeBothezat Impeller Co., Inc., New York.

FANS, SUPPLY AND EXHAUST
American Blower Co., Detroit, Mich.
Autovent Fan & Blower Co., Chicago, Ill.
Bayley Blower Co., Milwaukee, Wis.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Buffalo Forge Co., Buffalo, N. Y.
Clarage Fan Co., Kalamazoo, Mich.
DeBothezat Impeller Co., Inc., New York
Emerson Electric Mfg. Co., St. Louis, Mo.
Ilg Electric Ventilating Co., Chicago, Ill.
New York Blower Co., Chicago, Ill.
St. Louis Blow Pipe & Heater Co., Inc., St. Louis, Mo.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Wing Mfg. Co., L. J., New York.

FEEDERS, BOILER
Cashin Co., W. D., Boston, Mass.
Cissell Mfg. Co., W. M., Louisville, Ky.
Crane Co., Chicago, Ill.
Kieley & Mueller, Inc., New York.
McAlear Mfg. Co., Chicago, Ill.
McDonnell & Miller, Chicago, Ill.
Walworth Co., New York.

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FILTERS, FEED-WATER
Davis Engineering Corp., New York.

FITTINGS, ACID RESISTING
Crane Co., Chicago, Ill.
Duriron Company, Inc., The, Dayton, O.

FITTINGS, COMPRESSION PIPE
Nugent & Co., Inc., Wm. W., Chicago, Ill.

FITTINGS, FLANGED
Crane Co., Chicago, Ill.
Grinnell Co., Providence, R. I.
Illinois Malleable Iron Co., Chicago, Ill.
Walworth Co., New York

FLANGES
Crane Co., Chicago, Ill.
Illinois Malleable Iron Co., Chicago, Ill.
Jenkins Bros., New York.
Walworth Co., New York

GAS BURNERS
Cleveland Gas Burner & Appliance Co., Cleveland, Ohio.

GASKETS, ASBESTOS
Crane Co., Chicago, Ill.
Jenkins Bros., New York.

GASKETS, METALLIC
Crane Co., Chicago, Ill.
Jenkins Bros., New York.

GASKETS, RUBBER
Crane Co., Chicago, Ill.
Jenkins Bros., New York.

GAUGE BOARDS
American Schaeffer & Budenberg Div., Consolidated Ashcroft Hancock Co., Inc., Brooklyn, N. Y.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Dunham Co., C. A., Chicago, Ill.
Foxboro Co., Inc., The, Foxboro, Mass.
Marsh & Co., Jas. P., Chicago, Ill.

GAUGE GLASSES
American Schaeffer & Budenberg Div., Consolidated Ashcroft Hancock Co., Inc., Brooklyn, N. Y.
Crane Co., Chicago, Ill.
Jenkins Bros., New York.

GAUGES, ALTITUDE
American Radiator Co., Buffalo, N. Y.
American Schaeffer & Budenberg Div., Consolidated Ashcroft Hancock Co., Inc., Brooklyn, N. Y.
Bristol Co., The, Waterbury, Conn.
Foxboro Co., Inc., The, Foxboro, Mass.
Mercoid Corporation, Chicago, Ill.
National Radiator Corp., Johnstown, Pa.
Pierce, Butler & Pierce Mfg. Corp., New York.

GAUGES, DRAFT
American Schaeffer & Budenberg Div., Consolidated Ashcroft Hancock Co., Inc., Brooklyn, N. Y.
Bristol Co., The, Waterbury, Conn.
Foxboro Co., Inc., The, Foxboro, Mass.
Marsh & Co., Jas. P., Chicago, Ill.

GAUGES, HYDRAULIC
American Schaeffer & Budenberg Div., Consolidated Ashcroft Hancock Co., Inc., Brooklyn, N. Y.
Bristol Co., The, Waterbury, Conn.
Foxboro Co., Inc., The, Foxboro, Mass.
Marsh & Co., Jas. P., Chicago, Ill.
Mercoid Corporation, Chicago, Ill.

GAUGES, OUNCE GRADUATED
American Schaeffer & Budenberg Div., Consolidated Ashcroft Hancock Co., Inc., Brooklyn, N. Y.
Bristol Co., The, Waterbury, Conn.
Dunham Co., C. A., Chicago, Ill.
Hoffman Specialty Co., New York.
Illinois Engineering Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
Sterling Engineering Co., Milwaukee, Wis.
Trane Co., The, LaCrosse, Wis.

GAUGES, PRESSURE
American Radiator Co., Buffalo, N. Y.
American Schaeffer & Budenberg Div., Consolidated Ashcroft Hancock Co., Inc., Brooklyn, N. Y.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Bristol Co., The, Waterbury, Conn.
Crane Co., Chicago, Ill.
Dunham Co., C. A., Chicago, Ill.
Foxboro Co., Inc., The, Foxboro, Mass.
Hoffman Specialty Co., New York.
Illinois Engineering Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
Mercoid Corporation, Chicago, Ill.
National Radiator Corp., Johnstown, Pa.
Pierce, Butler & Pierce Mfg. Corp., New York.
Sterling Engineering Co., Milwaukee, Wis.
Trane Co., The, LaCrosse, Wis.

GAUGES, TANK
King-Seeley Corp., Ann Arbor, Mich.

GAUGES, VACUUM
American Radiator Co., Buffalo, N. Y.
American Schaeffer & Budenberg Div., Consolidated Ashcroft Hancock Co., Inc., Brooklyn, N. Y.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Bristol Co., The, Waterbury, Conn.
Crane Co., Chicago, Ill.
Dunham Co., C. A., Chicago, Ill.
Foxboro Co., Inc., The, Foxboro, Mass.
Hoffman Specialty Co., New York.
Illinois Engineering Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
Mercoid Corporation, Chicago, Ill.
Sterling Engineering Co., Milwaukee, Wis.
Trane Co., The, LaCrosse, Wis.
Webster & Co., Warren, Camden, N. J.

GAUGES, VACUUM (COMPOUND)
American Schaeffer & Budenberg Div., Consolidated Ashcroft Hancock Co., Inc., Brooklyn, N. Y.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Bristol Co., The, Waterbury, Conn.
Cashin Co., W. D., Boston, Mass.
Dunham Co., C. A., Chicago, Ill.
Foxboro Co., Inc., The, Foxboro, Mass.
Hoffman Specialty Co., New York.
Illinois Engineering Co., Chicago, Ill.
Mercoid Corporation, Chicago, Ill.
Pierce, Butler & Pierce Mfg. Corp., New York.
Sterling Engineering Co., Milwaukee, Wis.
Trane Co., The, LaCrosse, Wis.
Webster & Co., Warren, Camden, N. J.

GAUGES, WATER
American Schaeffer & Budenberg Div., Consolidated Ashcroft Hancock Co., Inc., Brooklyn, N. Y.
Bristol Co., The, Waterbury, Conn.
Crane Co., Chicago, Ill.
Mercoid Corporation, Chicago, Ill.
National Radiator Corp., Johnstown, Pa.
Walworth Co., New York

GENERATOR COOLING SYSTEMS
American Blower Co., Detroit, Mich.
Bayley Blower Co., Milwaukee, Wis.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Buffalo Forge Co., Buffalo, N. Y.
Reed Air Filter Co., Inc., Louisville, Ky.
Schutte & Koerting Co., Philadelphia, Pa.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

GOVERNORS, (PUMP)
Atlas Valve Co., Newark, N. J.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Crane Co., Chicago, Ill.
Davis Regulator Co., G. M., Chicago, Ill.
Dunham Co., C. A., Chicago, Ill.
Kieley & Mueller, Inc., New York.
Webster & Co., Warren, Camden, N. J.

GRATES, DUMPING
Fitzgibbons Boiler Co., Inc., New York.
Kewanee Boiler Corp., Kewanee, Ill.
Stanwood Corporation, Cincinnati, Ohio

GRATES, ROCKING
Kewanee Boiler Corp., Kewanee, Ill.
Page Boiler Co., Wm. H., New York.
Stanwood Corporation, Cincinnati, Ohio.

GRATES, SHAKING
Fitzgibbons Boiler Co., Inc., New York.
Kewanee Boiler Corp., Kewanee, Ill.
Page Boiler Co., Wm. H., New York.
Stanwood Corporation, Cincinnati, Ohio.

GRATES, SHAKING AND DUMPING
Frost Mfg. Co., Galesburg, Ill.
Kewanee Boiler Corp., Kewanee, Ill.
Stanwood Corporation, Cincinnati, Ohio.

GRATES, SHAKING, CIRCULAR
Fitzgibbons Boiler Co., Inc., New York.

GRATES, STATIONARY
Fitzgibbons Boiler Co., Inc., New York.
Frost Mfg. Co., Galesburg, Ill.
Stanwood Corporation, Cincinnati, Ohio.

HEAT CABINETS
Circulair Heat, Inc., Louisville, Ky.
McQuay Radiator Corp., Chicago, Ill.
Modine Mfg. Co., Racine, Wis.
Nelson Corp., Herman, The, Moline, Ill.
Reed Air Filter Co., Inc., Louisville, Ky.
Thermal Units Co., Chicago, Ill.
Trane Co., The, LaCrosse, Wis.

HEATERS, AIR, FAN SYSTEM
Aerofin Corp., Newark, N. J.
American Blower Co., Detroit, Mich.
Autovent Fan & Blower Co., Chicago, Ill.
Bayley Blower Co., Milwaukee, Wis.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Buffalo Forge Co., Buffalo, N. Y.
Clarage Fan Co., Kalamazoo, Mich.
Dwyer Equipment Co., Chicago, Ill.
Ilg Electric Ventilating Co., Chicago, Ill.
Modine Mfg. Co., Racine, Wis.
National Air Filter Co., Chicago, Ill.
New York Blower Co., Chicago, Ill.
Rome-Turney Radiator Co., Rome, N. Y.
Schutte & Koerting Co., Philadelphia, Pa.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Thermal Units Co., Chicago, Ill.
Trane Co., The, LaCrosse, Wis.
Wing Mfg. Co., L. J., New York.

HEATERS, DOMESTIC WATER
Alberger Heater Co., Buffalo, N. Y.
American District Steam Co., North Tonawanda, N. Y.
American Radiator Co., Buffalo, N. Y.
Crane Co., Chicago, Ill.
Dahlquist Mfg. Co., South Boston, Mass.
Davis Engineering Corp., New York.
Excelso Products Corporation, Buffalo, N. Y.
Foster Wheeler Corporation, New York.
Frank Heater & Engineering Co., O. E., Buffalo, N. Y.
Illinois Malleable Iron Co., Chicago, Ill.
Kewanee Boiler Corp., Kewanee, Ill.
Monitor Boiler Co., Philadelphia, Pa.
National Pipe Bending Co., New Haven, Conn.
Page Boiler Co., Wm. H., New York.
Patterson-Kelley Co., New York.
Pierce, Butler & Pierce Mfg. Corp., New York.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Sims Co., The, Erie, Pa.
Weil-McLain Co., Chicago, Ill.
Whitlock Coil Pipe Co., Hartford, Conn

HEATERS, ELECTRICAL UNIT
American Blower Co., Detroit, Mich.
Ilg Electric Ventilating Co., Chicago, Ill.

HEATERS, FEED WATER, (CLOSED)
Alberger Heater Co., Buffalo, N. Y.
Davis Engineering Corp., New York.
Foster Wheeler Corporation, New York.
Frank Heater & Engineering Co., O. E., Buffalo, N. Y.
Frost Mfg. Co., Galesburg, Ill.
Illinois Malleable Iron Co., Chicago, Ill.
National Pipe Bending Co., New Haven, Conn.
Patterson-Kelley Co., New York.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Schutte & Koerting Co., Philadelphia, Pa.
Sims Co., The, Erie, Pa.
Stanwood Corporation, Cincinnati, Ohio
Whitlock Coil Pipe Co., Hartford, Conn.

HEATERS, FEED WATER, (OPEN)
Frost Mfg. Co., Galesburg, Ill.
National Pipe Bending Co., New Haven, Conn.
Sims Co., The, Erie, Pa.
Stanwood Corporation, Cincinnati, Ohio.
Webster & Co., Warren, Camden, N. J.

HEATERS, FUEL-OIL
Alberger Heater Co., Buffalo, N. Y.
Clarage Fan Co., Kalamazoo, Mich.
Davis Engineering Corp., New York.
Electrol, Inc., St. Louis, Mo.
Excelso Products Corporation, Buffalo, N. Y.
Frank Heater & Engineering Co., O. E., Buffalo, N. Y.
National Air Filter Co., Chicago, Ill.
National Pipe Bending Co., New Haven, Conn.
Patterson-Kelley Co., New York.
Ross Heater & Mfg. Co., Buffalo, N. Y.
Schutte & Koerting Co., Philadelphia, Pa.
Whitlock Coil Pipe Co., Hartford, Conn.

HEATERS, UNIT
American Blower Co., Detroit, Mich.
Autovent Fan & Blower Co., Chicago, Ill.
Bayley Blower Co., Milwaukee, Wis.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Buffalo Forge Co., Buffalo, N. Y.
Clarage Fan Co., Kalamazoo, Mich.
Dwyer Equipment Co., Chicago, Ill
Ilg Electric Ventilating Co., Chicago, Ill.
McQuay Radiator Corp., Chicago, Ill.
Modine Mfg. Co., Racine, Wis.
Nelson Corp., Herman, The, Moline, Ill.
New York Blower Co., Chicago, Ill.
Peerless Unit Ventilation Co., Inc., Bridgeport, Conn.
Skinner Bros. Mfg. Co., St. Louis, Mo.
St. Louis Blow Pipe & Heater Co., Inc., St. Louis, Mo.
Sturtevant Co., B. F., Hyde Park, Boston, Mass
Thermal Units Co., Chicago, Ill.
Trane Co., The, LaCrosse, Wis.
Wing Mfg. Co., L. J., New York.
York Heating & Ventilating Corp., Phila., Pa.
Young Radiator Co., Racine, Wis.

HEATING SYSTEMS, VACUUM
Barnes & Jones, Boston, Mass.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Cashin Co., W. D., Boston, Mass.
Dunham Co., C. A., Chicago, Ill.
Haines & Co., Wm. S., Philadelphia, Pa.
Hoffman Specialty Co., New York.
Illinois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Sarco Co., Inc., New York.
Spencer Heater Co., Williamsport, Pa.
Sterling Engineering Co., Milwaukee, Wis.
Trane Co., The, LaCrosse, Wis.
Webster & Co., Warren, Camden, N. J.

HEATING SYSTEMS, VAPOR
American District Steam Co., North Tonawanda, N. Y.
Barnes & Jones, Boston, Mass.
Bishop & Babcock Sales Co., Cleveland Ohio.
Cashin Co., W. D., Boston, Mass.
Dunham Co., C. A., Chicago, Ill.
Gorton Heating Corporation, New York
Haines & Co., Wm. S., Philadelphia, Pa.
Hoffman Specialty Co., New York.
Illinois Engineering Co., Chicago, Ill.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Page Boiler Co., Wm. H., New York
Sarco Co., Inc., New York.
Simplex Heating Specialty Co., Inc., Lynchburg, Va.
Spencer Heater Co., Williamsport, Pa.
Sterling Engineering Co., Milwaukee, Wis.
Trane Co., The, LaCrosse, Wis.
Vapor Engineering Co., New York.
Webster & Co., Warren, Camden, N. J.

HEATING SYSTEMS, WATER
American Radiator Co., Buffalo, N. Y.
Bishop & Babcock Sales Co., Cleveland Ohio.
Grinnell Co., Providence, R. I.
Hornung, J. C., Chicago, Ill.
Mueller Co., Decatur, Ill.
Page Boiler Co., Wm. H., New York
Ross Heater & Mfg. Co., Buffalo, N. Y.
Spencer Heater Co., Williamsport, Pa.

HUMIDIFIERS
American Blower Co., Detroit, Mich.
Bayley Blower Co., Milwaukee, Wis.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Buffalo Forge Co., Buffalo, N. Y.
Carrier Engineering Corp., Newark, N. J.
Clarage Fan Co., Kalamazoo, Mich.
Connor Co., Inc., The W. B., New York.
General Air Filters Corp., New York.
Grinnell Co., Providence, R. I.
Johnson Service Co., Milwaukee, Wis.
National Air Filter Co., Chicago, Ill.
National Regulator Co., Chicago, Ill.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
York Heating & Ventilating Corp., Phila., Pa.

HUMIDITY CONTROL
American Schaeffer & Budenberg Div., Consolidated Ashcroft Hancock Co., Inc., Brooklyn, N. Y.
Bayley Blower Co., Milwaukee, Wis.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Carrier Engineering Corp., Newark, N. J.
Clarage Fan Co., Kalamazoo, Mich.
Foxboro Co., Inc., The, Foxboro, Mass.
Grinnell Co., Providence, R. I.
Johnson Service Co., Milwaukee, Wis.
National Air Filter Co., Chicago, Ill.
National Regulator Co., Chicago, Ill.
Powers Regulator Co., Chicago, Ill.

INSTRUMENTS, ELECTRIC MEASURING
Bristol Co., The, Waterbury, Conn.

INSTRUMENTS, INDICATING AND RECORDING
American Schaeffer & Budenberg Div., Consolidated Ashcroft Hancock Co., Inc., Brooklyn, N. Y.
Bristol Co., The, Waterbury, Conn.
Foxboro Co., Inc., The, Foxboro, Mass.
Marsh & Co., Jas. P., Chicago, Ill.
Mercoid Corporation, Chicago, Ill.

INSULATION, BOILER, PIPE, ETC.
(See Covering, Boiler, Pipe, etc.)

INSULATION, BUILDING
Banner Rock Products Co., Alexandria, Ind.
Celotex Co., Chicago, Ill.
Flax-li-num Insulating Co., St. Paul, Minn.
Insulite Co., Minneapolis, Minn.

MANOMETERS
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American Schaeffer & Budenberg Div., Consolidated Ashcroft Hancock Co., Inc., Brooklyn, N. Y.
Foxboro Co., Inc., The, Foxboro, Mass

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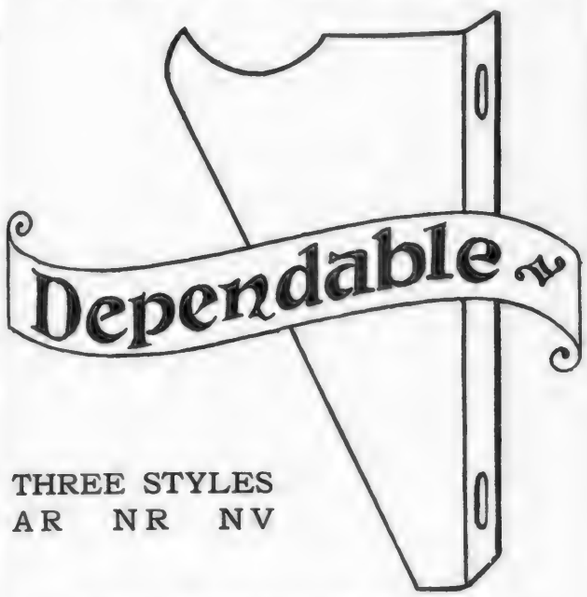

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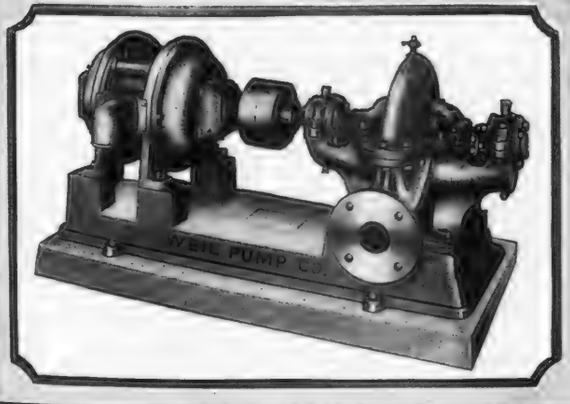

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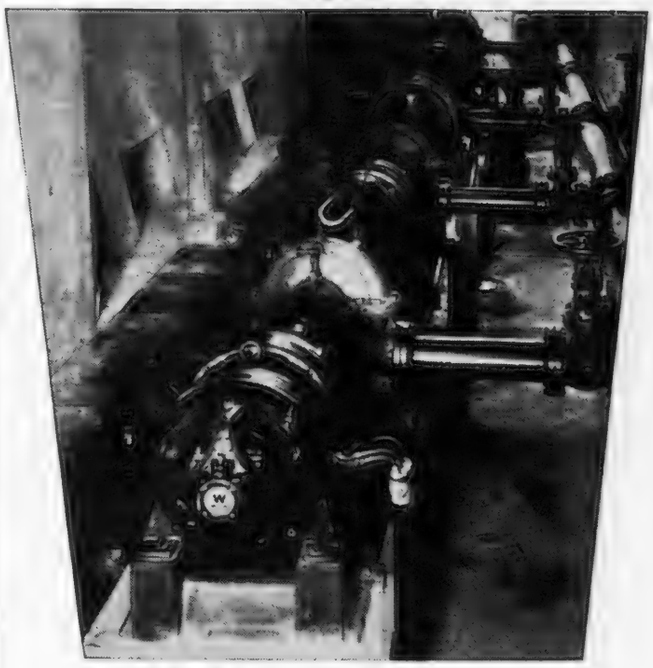

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DeBothezat Impeller Co., Inc., New York
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Sturtevant Co., B. F., Hyde Park. Boston, Mass.
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Central Station Steam Co., Detroit, Mich.

METERS, FEED WATER
Central Station Steam Co., Detroit, Mich.
Webster & Co., Warren, Camden, N. J.

METERS, FLOW
Foxboro Co., Inc., The, Foxboro, Mass.

METERS, PITOT TUBE
American Blower Co., Detroit, Mich.
Buffalo Forge Co., Buffalo, N. Y.

METERS, STEAM
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Duriron Company, Inc., The, Dayton, O.

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Bayley Blower Co., Milwaukee, Wis.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Buffalo Forge Co., Buffalo, N. Y.
Carrier Engineering Corp., Newark, N. J.
Clarage Fan Co., Kalamazoo, Mich.
Connor Co., Inc., The W. B., New York.
Dunham Co., C. A., Chicago, Ill.
General Air Filters Corp., New York.
Schutte & Koerting Co., Philadelphia, Pa.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

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Hardinge Bros., Inc., Chicago, Ill.
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McIlvaine Burner Corporation, Chicago, Ill.
Pascoe Company, The Wm. H., Chicago, Ill.
Preferred Oil Burners, Inc., Peoria, Ill.

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Buffalo Forge Co., Buffalo, N. Y.
Hornung, J. C., Chicago, Ill.
Janette Mfg. Co., Chicago, Ill.
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Schutte & Koerting Co., Philadelphia. Pa.
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McAlear Mfg. Co., Chicago, Ill.
McDonnell & Miller, Chicago, Ill.
Mercoid Corporation, Chicago, Ill.
Time-O-Stat Controls Co., Elkhart, Ind.
Webster Electric Co., Racine Wis
White Mfg. Co., St. Paul, Minn.

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Duriron Company, Inc., The, Dayton, O.

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Crane Co., Chicago, Ill.
National Tube Co., Pittsburgh, Pa.

PIPE BENDING
Badger & Sons Co., E. B., Boston, Mass
Crane Co., Chicago, Ill.
Grinnell Co., Providence, R. I.
National Pipe Bending Co., New Haven, Conn.
Walworth Co., New York
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PIPE THREADING & CUTTING MACHINES
Crane Co., Chicago, Ill.
National Pipe Bending Co., New Haven, Conn.

PRESSURE REDUCING VALVES
(See Regulators, Pressure).

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Horton Mfg. Co., Minneapolis, Minn.

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Duriron Company, Inc., The, Dayton, O.

PUMPS, CENTRIFUGAL
American Steam Pump Co., Battle Creek, Mich.
Buffalo Steam Pump Co., Buffalo, N. Y.
Chicago Pump Co., Chicago, Ill.
Dunham Co., C. A., Chicago, Ill.
Economy Pumping Machinery Co., Chicago, Ill.
Foster Wheeler Corporation, New York.
Nash Engineering Co., So. Norwalk, Conn.
Trane Co., The, LaCrosse, Wis.
Weil Pump Co., Chicago, Ill.

PUMPS, CENTRIFUGAL, VACUUM HEATING
Ames Pump Co., New York.
Chicago Pump Co., Chicago, Ill.
Dunham Co., C. A., Chicago, Ill.
Economy Pumping Machinery Co., Chicago, Ill.
Nash Engineering Co., So. Norwalk, Conn.
Skidmore Corp., Chicago, Ill.
Trane Co., The, LaCrosse, Wis.
Weil Pump Co., Chicago, Ill.

PUMPS, CONDENSATION
American Steam Pump Co., Battle Creek, Mich.
Ames Pump Co., New York.
Buffalo Steam Pump Co., Buffalo, N. Y.
Chicago Pump Co., Chicago, Ill.
Connor Co., Inc., The W. B., New York.
Dunham Co., C. A., Chicago, Ill.
Eclipse Fuel Engineering Co., Rockford,
Economy Pumping Machinery Co., Chicago, Ill.
Nash Engineering Co., So. Norwalk, Conn.
Sterling Engineering Co., Milwaukee, Wis.
Trane Co., The, LaCrosse, Wis.
Weil Pump Co., Chicago, Ill.

PUMPS, OIL
Connor Co., Inc., The W. B., New York.
Janette Mfg. Co., Chicago, Ill.
Nugent & Co., Inc., Wm. W., Chicago, Ill.

PUMPS, RECIPROCATING STEAM
American Steam Pump Co., Battle Creek, Mich.
Buffalo Steam Pump Co., Buffalo, N. Y.

PUMPS, SUMP
American Steam Pump Co., Battle Creek, Mich.
Buffalo Steam Pump Co., Buffalo, N. Y.
Economy Pumping Machinery Co., Chicago, Ill.
Janette Mfg. Co., Chicago, Ill.
Nash Engineering Co., So. Norwalk, Conn.
Weil Pump Co., Chicago, Ill.

PUMPS, TURBINE
Foster Wheeler Corporation, New York
Nash Engineering Co., So. Norwalk, Conn.

PUMPS, VACUUM
American Steam Pump Co., Battle Creek Mich
Buffalo Steam Pump Co., Buffalo, N. Y
Dunham Co., C. A., Chicago, Ill.
Economy Pumping Machinery Co., Chicago, Ill.
Foster Wheeler Corporation, New York.
Janette Mfg. Co., Chicago, Ill.
Nash Engineering Co., So. Norwalk, Conn.
Skidmore Corp., Chicago, Ill.
Trane Co., The, LaCrosse, Wis.
Weil Pump Co., Chicago, Ill.

RADIATOR ENCLOSURES OR SHIELDS
Acme Radiator Shield Co., Cincinnati, Ohio.
American Metal Products Corp., St. Louis, Mo.

RADIATOR HANGERS
American Radiator Co., Buffalo, N. Y.
Grinnell Co., Providence, R. I.
Hartmann Co., Charles, Brooklyn, N. Y.
Healy-Ruff Co., St. Paul, Minn.
Kewanee Boiler Corp., Kewanee, Ill.
McAlear Mfg. Co., Chicago, Ill.

RADIATORS, BRASS
Circulair Heat, Inc., Louisville, Ky.
Rome Brass Radiator Corp., New York.
Shaw-Perkins Mfg. Co., Pittsburgh, Pa.

RADIATORS, STEAM & WATER
American Radiator Co., Buffalo, N. Y.
Burnham Boiler Corp., Irvington, N. Y.
Crane Co., Chicago, Ill.
Kewanee Boiler Corp., Kewanee, Ill.
National Radiator Corp., Johnstown, Pa.
Nelson Corp., Herman, The, Moline, Ill.
Page Boiler Co., Wm. H., New York.
Pierce, Butler & Pierce Mfg. Corp., New York.

RECEIVERS, AIR
Brownell Co., The, Dayton, Ohio.
Frost Mfg. Co., Galesburg, Ill.
National Pipe Bending Co., New Haven, Conn.
Vapor Engineering Co., New York.
Whitlock Coil Pipe Co., Hartford, Conn.

RECEIVERS, CONDENSATION
American District Steam Co., North Tonawanda, N. Y.
American Steam Pump Co., Battle Creek, Mich.
Connor Co., Inc., The W. B., New York.
Crane Co., Chicago, Ill.
Dunham Co., C. A., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
National Pipe Bending Co., New Haven, Conn.
Trane Co., The, LaCrosse, Wis.
Vapor Engineering Co., New York.
Whitlock Coil Pipe Co., Hartford, Conn.

REGULATORS, BOILER-FEED
Atlas Valve Co., Newark, N. J.
Cissell Mfg. Co., W. M., Louisville, Ky.
Kieley & Mueller, Inc., New York.
McAlear Mfg. Co., Chicago, Ill.
McDonnell & Miller, Chicago, Ill.

REGULATORS, DAMPER
American District Steam Co., North Tonawanda, N. Y.
American Radiator Co., Buffalo, N. Y.
Atlas Valve Co., Newark, N. J.
Dunham Co., C. A., Chicago, Ill.
Fulton Sylphon Co., Knoxville, Tenn.
Gorton Heating Corporation, New York.
Hoffman Specialty Co., New York.
Illinois Engineering Co., Chicago, Ill.
Johnson Service Co., Milwaukee, Wis.
Kieley & Mueller, Inc., New York.
McAlear Mfg. Co., Chicago, Ill.
National Regulator Co., Chicago, Ill.
Page Boiler Co., Wm. H., New York.
Powers Regulator Co., Chicago, Ill.
Sarco Co., Inc., New York.
Sheer Co., H. M., Quincy, Ill.
Simplex Heating Specialty Co., Inc., Lynchburg, Va.
Sterling Engineering Co., Milwaukee, Wis.
Trane Co., The, LaCrosse, Wis.
White Mfg. Co., St. Paul, Minn.
Wing Mfg. Co., L. J., New York.

REGULATORS, PRESSURE
American District Steam Co., North Tonawanda, N. Y.
Atlas Valve Co., Newark, N. J.
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Bristol Co., The, Waterbury, Conn.
Crane Co., Chicago, Ill.
Davis Regulator Co., G. M., Chicago, Ill.
Dunham Co., C. A., Chicago, Ill.
Hornung, J. C., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill
Jenkins Bros., New York.
Johnson Service Co., Milwaukee, Wis.
Kainer & Company, Chicago, Ill.
Kieley & Mueller, Inc., New York.
Lytton Mfg. Corp., Franklin, Va.
McAlear Mfg. Co., Chicago, Ill.
Mueller Co., Decatur, Ill.
Powers Regulator Co., Chicago, Ill.
Schutte & Koerting Co., Philadelphia, Pa
Teeple Co., L. R., Portland, Oregon

REGULATORS, TEMPERATURE
(See Temperature Control).

SEPARATORS, OIL
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Crane Co., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
National Pipe Bending Co., New Haven, Conn.
Patterson-Kelley Co., New York.
Schutte & Koerting Co., Philadelphia, Pa.
Webster & Co., Warren, Camden, N. J.

SEPARATORS, STEAM
American District Steam Co., North Tonawanda, N. Y.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Crane Co., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
National Pipe Bending Co., New Haven, Conn.
Sims Co., The, Erie, Pa.
Swartwout Co., Cleveland, Ohio.
Webster & Co., Warren, Camden, N. J.

SPRAY COOLING SYSTEMS
Badger & Sons Co., E. B., Boston, Mass.
Bayley Blower Co., Milwaukee, Wis.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Buffalo Forge Co., Buffalo, N. Y.
Connor Co., Inc., The W. B., New York
General Air Filters Corp., New York
Schutte & Koerting Co., Philadelphia, Pa.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

SPRAY NOZZLES
(See Nozzles, Spray).

STOKERS, MECHANICAL
General Stoker Corp., New York.

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Bishop & Babcock Sales Co., Cleveland, Ohio.
Dunham Co. C. A., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill
Janette Mfg. Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Nugent & Co., Inc., Wm. W., Chicago, Ill.
Sarco Co., Inc., New York.
Schutte & Koerting Co., Philadelphia, Pa.

STRAINERS, STEAM
American District Steam Co., North Tonawanda, N. Y.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Illinois Engineering Co., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Sarco Co., Inc., New York.
Schutte & Koerting Co., Philadelphia Pa.

STRAINERS, WATER
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Illinois Engineering Co., Chicago, Ill
McAlear Mfg. Co., Chicago, Ill.
Ross Heater & Mfg. Co., Buffalo, N. Y
Sarco Co., Inc., New York.
Schutte & Koerting Co., Philadelphia. Pa.

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American Radiator Co., Buffalo, N. Y
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Atlas Valve Co., Newark, N. J.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Bristol Co., The, Waterbury, Conn.
Carrier Engineering Corp., Newark N. J.
Foxboro Co., Inc., The, Foxboro, Mass
Fulton Sylphon Co., Knoxville, Tenn
Hornung, J. C., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill
Kieley & Mueller, Inc., New York.
Mercoid Corporation, Chicago, Ill.
National Regulator Co., Chicago, Ill
Powers Regulator Co., Chicago, Ill.
Raymond, F. I., Chicago, Ill.
Sarco Co., Inc., New York.
Sheer Co., H. M., Quincy, Ill.
Sterling Engineering Co., Milwaukee Wis.
Teeple Co., L. R., Portland, Oregon
Time-O-Stat Controls Co., Elkhart, Ind.
Trane Co., The, LaCrosse, Wis.
White Mfg. Co., St. Paul, Minn.

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American Schaeffer & Budenberg Div., Consolidated Ashcroft Hancock Co., Inc., Brooklyn, N. Y.
Bristol Co., The, Waterbury, Conn.
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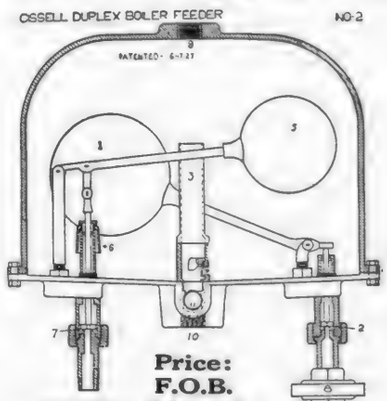
While Also Increasing Its Efficiency



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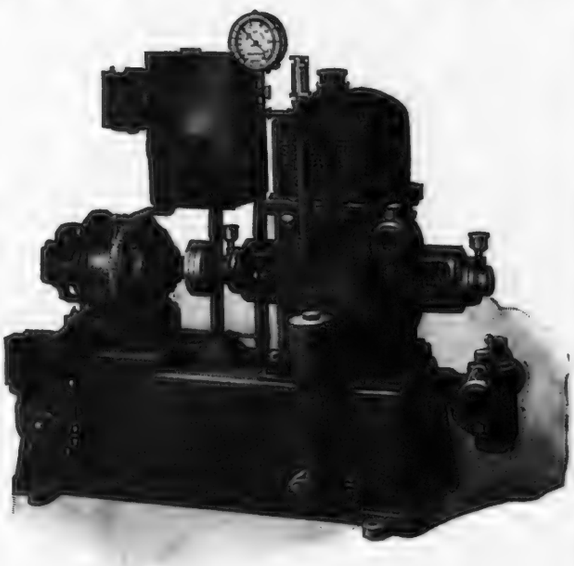
SKIDMORE



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The Skidmore pump on interceptor base is designed to give low water line operation without pitting.

The unit is self contained, ball bearing, and operated by one motor. It produces vacuum on the system even when operating on float control, a desirable feature.

The unit consists of two pumps in one housing on one shaft, an air pump and a centrifugal pump for boiler feed. Motor and pump are mounted directly on interceptor base. This construction means compactness in design and minimum floor space occupied.

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Powers Regulator Co., Chicago, Ill.

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Bristol Co., The, Waterbury, Conn.
Johnson Service Co., Milwaukee, Wis.
Mercoid Corporation, Chicago, Ill.
Modine Mfg. Co., Racine, Wis.
National Regulator Co., Chicago, Ill.
Powers Regulator Co., Chicago, Ill.
Sarco Co., Inc., New York.
Sheer Co., H. M., Quincy, Ill.
Time-O-Stat Controls Co., Elkhart, Ind.
White Mfg. Co., St. Paul, Minn.

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Crane Co., Chicago, Ill.
Swartwout Co., Cleveland, Ohio.
Trerice Co., H. O., Detroit, Mich.

TRAPS, FLOAT

Connor Co., Inc., The W. B., New York.
Crane Co., Chicago, Ill.
General Air Filters Corp., New York.
Sarco Co. Inc., New York.
Swartwout Co., Cleveland, Ohio.

TRAPS, FLOAT & THERMOSTATIC

Dunham Co., C. A., Chicago, Ill.

TRAPS, INVERTED BUCKET (STEAM AND AIR)

Armstrong Machine Works, Three Rivers, Mich.

TRAPS, LIFTING

Crane Co., Chicago, Ill.
Lytton Mfg. Corp., Franklin, Va.
Swartwout Co., Cleveland, Ohio.

TRAPS, RADIATOR

American District Steam Co., North Tonawanda, N. Y.
Armstrong Machine Works, Three Rivers, Mich.
Barnes & Jones, Boston, Mass.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Cashin Co., W. D., Boston, Mass.
Crane Co., Chicago, Ill.
Dunham Co., C. A., Chicago, Ill.
Haines & Co., Wm. S., Philadelphia, Pa.
Hoffman Specialty Co., New York.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
National Radiator Corp., Johnstown, Pa.
Sarco Co., Inc., New York.
Sterling Engineering Co., Milwaukee, Wis.
Trane Co., The, LaCrosse, Wis.
Vapor Engineering Co., New York.
Webster & Co., Warren, Camden, N. J.

TRAPS, RETURN

American Blower Co., Detroit, Mich.
American District Steam Co., North Tonawanda, N. Y.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Cashin Co., W. D., Boston, Mass.
Crane Co., Chicago, Ill.
Dunham Co., C. A., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Kieley & Mueller, Inc., New York.
Lytton Mfg. Corp., Franklin, Va.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Sarco Co., Inc., New York.
Simplex Heating Specialty Co., Inc., Lynchburg, Va.
Sterling Engineering Co., Milwaukee, Wis.
Swartwout Co., Cleveland, Ohio.
Trane Co., The, LaCrosse, Wis.
Webster & Co., Warren, Camden, N. J.

TRAPS, STEAM

American Blower Co., Detroit, Mich.
American District Steam Co., North Tonawanda, N. Y.
American Schaeffer & Budenberg Div., Consolidated Ashcroft Hancock Co., Inc., Brooklyn, N. Y.
Barnes & Jones, Boston, Mass.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Cashin Co., W. D., Boston, Mass.
Connor Co., Inc., The W. B., New York.
Crane Co., Chicago, Ill.
Davis Engineering Corp., New York.
Davis Regulator Co., G. M., Chicago, Ill.
Dunham Co., C. A., Chicago, Ill.
General Air Filters Corp., New York.
Haines & Co., Wm. S., Philadelphia, Pa.
Hoffman Specialty Co., New York.
Illinois Engineering Co., Chicago, Ill.
Kieley & Mueller, Inc., New York.
Lytton Mfg. Corp., Franklin, Va.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Powers Regulator Co., Chicago, Ill.
Sarco Co., Inc., New York.
Trerice Co., H. O., Detroit, Mich.

TRAPS, VACUUM

American Blower Co., Detroit, Mich.
Barnes & Jones, Boston, Mass.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Crane Co., Chicago, Ill.
Dunham Co., C. A., Chicago, Ill.
Haines & Co., Wm. S., Philadelphia, Pa.
Hoffman Specialty Co., New York.
Illinois Engineering Co., Chicago, Ill.
Lytton Mfg. Corp., Franklin, Va.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
Sarco Co., Inc., New York.
Schutte & Koerting Co., Philadelphia, Pa.
Sterling Engineering Co., Milwaukee, Wis.
Swartwout Co., Cleveland, Ohio.
Trane Co., The, LaCrosse, Wis.
Webster & Co., Warren, Camden, N. J.

TUBING, COPPER AND BRASS

Crane Co., Chicago, Ill.
Wolverine Tube Co., Detroit, Mich.

TURBINES, STEAM

Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Wing Mfg. Co., L. J., New York.

TURBO-BLOWERS

Bayley Blower Co., Milwaukee, Wis.
Buffalo Forge Co., Buffalo, N. Y.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.
Wing Mfg. Co., L. J., New York.

UNDERGROUND PIPE CONDUITS

American District Steam Co., North Tonawanda, N. Y.
Ric-wiL Co., The, Cleveland, Ohio.

UNIT HEATERS

(See Heaters, Unit)

VACUUM CLEANING APPARATUS

American Radiator Co., Buffalo, N. Y.
Sturtevant Co., B. F., Hyde Park, Boston, Mass.

VALVES, ACID RESISTING

Crane Co., Chicago, Ill.
Duriron Company, Inc., The, Dayton, O.

VALVES, AIR, AUTOMATIC

American Radiator Co., Buffalo, N. Y.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Crane Co., Chicago, Ill.
Dunham Co., C. A., Chicago, Ill.
Fulton Sylphon Co., Knoxville, Tenn.
Hoffman Specialty Co., New York.
Jenkins Bros., New York.
Marsh & Co., Jas. P., Chicago, Ill.
McAlear Mfg. Co., Chicago, Ill.
National Radiator Corp., Johnstown, Pa.
Page Boiler Co., Wm. H., New York.
Powers Regulator Co., Chicago, Ill.
Russell & Co., W. A., New York.

VALVES, AIR RELIEF

American Radiator Co., Buffalo, N. Y.
Barnes & Jones, Boston, Mass.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Crane Co., Chicago, Ill.
Davis Regulator Co., G. M., Chicago, Ill.
Gorton Heating Corporation, New York.
Kennedy Valve Mfg. Co., Elmira, N. Y.
McAlear Mfg. Co., Chicago, Ill.
National Radiator Corp., Johnstown, Pa.
Sarco Co., Inc., New York.
Trane Co., The, LaCrosse, Wis.

VALVES, BACK PRESSURE

Crane Co., Chicago, Ill.
Davis Regulator Co., G. M., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Illinois Malleable Iron Co., Chicago, Ill.
Jenkins Bros., New York.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Kieley & Mueller, Inc., New York.
McAlear Mfg. Co., Chicago, Ill.
Schutte & Koerting Co., Philadelphia, Pa.
Walworth Co., New York

VALVES, BALANCED

Crane Co., Chicago, Ill.
Davis Regulator Co., G. M., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
Kieley & Mueller, Inc., New York.
McAlear Mfg. Co., Chicago, Ill.
Powers Regulator Co., Chicago, Ill.
Schutte & Koerting Co., Philadelphia, Pa.

VALVES, BLOW-OFF

Crane Co., Chicago, Ill.
Jenkins Bros., New York.
Lytton Mfg. Corp., Franklin, Va.
National Radiator Corp., Johnstown, Pa.
Walworth Co., New York

VALVES, CHECK

Crane Co., Chicago, Ill.
Dunham Co., C. A., Chicago, Ill.
Grinnell Co., Providence, R. I.
Illinois Malleable Iron Co., Chicago, Ill.
Jenkins Bros., New York.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Schutte & Koerting Co., Philadelphia, Pa.
Walworth Co., New York.

VALVES, FLOAT

Atlas Valve Co., Newark, N. J.
Crane Co., Chicago, Ill.
Davis Regulator Co., G. M., Chicago, Ill.
Dunham Co., C. A., Chicago, Ill.
Grinnell Co., Providence, R. I.
Illinois Engineering Co., Chicago, Ill.
Kieley & Mueller, Inc., New York.
McAlear Mfg. Co., Chicago, Ill.
National Radiator Corp., Johnstown, Pa.
Schutte & Koerting Co., Philadelphia, Pa.
Time-O-Stat Controls Co., Elkhart, Ind.

VALVES, GATE

American District Steam Co., North Tonawanda, N. Y.
Crane Co., Chicago, Ill.
Grinnell Co., Providence, R. I.
Illinois Malleable Iron Co., Chicago, Ill.
Jenkins Bros., New York.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Marsh Valve Co., Dunkirk, N. Y.
National Radiator Corp., Johnstown, Pa.
Walworth Co., New York.

VALVES, GLOBE, ANGLE & CROSS

Crane Co., Chicago, Ill.
Grinnell Co., Providence, R. I.
Illinois Malleable Iron Co., Chicago, Ill.
Jenkins Bros., New York.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Marsh Valve Co., Dunkirk, N. Y.
National Radiator Corp., Johnstown, Pa.
Powers Regulator Co., Chicago, Ill.
Schutte & Koerting Co., Phila., Pa.
Walworth Co., New York.

VALVES, HYDRAULIC-OPERATING

Crane Co., Chicago, Ill.
Jenkins Bros., New York.
Kieley & Mueller, Inc., New York.
Walworth Co., New York

VALVES, MAGNETIC

Time-O-Stat Controls Co., Elkhart, Ind.

VALVES, NON-RETURN

Crane Co., Chicago, Ill.
Davis Regulator Co., G. M., Chicago, Ill.
Dunham Co., C. A., Chicago, Ill.
Grinnell Co., Providence, R. I.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Kieley & Mueller, Inc., New York.
McAlear Mfg. Co., Chicago, Ill.
National Radiator Corp., Johnstown, Pa.
Schutte & Koerting Co., Philadelphia, Pa.
Walworth Co., New York

VALVES, RADIATOR

American District Steam Co., North Tonawanda, N. Y.
American Radiator Co., Buffalo, N. Y.
Barnes & Jones, Boston, Mass.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Cashin Co., W. D., Boston, Mass.
Crane Co., Chicago, Ill.
Dunham Co., C. A., Chicago, Ill.
Fulton Sylphon Co., Knoxville, Tenn.
Gorton Heating Corporation, New York.
Haines & Co., Wm. S., Philadelphia, Pa.
Hoffman Specialty Co., New York.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
Kennedy Valve Mfg. Co., Elmira, N. Y.
Marsh & Co., Jas. P., Chicago, Ill.
Marsh Valve Co., Dunkirk, N. Y.
National Radiator Corp., Johnstown, Pa.
Page Boiler Co., Wm. H., New York.
Pierce, Butler & Pierce Mfg. Corp., New York.
Powers Regulator Co., Chicago, Ill.
Sarco Co., Inc., New York.
Schutte & Koerting Co., Philadelphia, Pa.
Simplex Heating Specialty Co., Inc., Lynchburg, Va.
Sterling Engineering Co., Milwaukee, Wis.
Trane Co., The, LaCrosse, Wis.
Vapor Engineering Co., New York.
Walworth Co., New York
Webster & Co., Warren, Camden, N. J.

VALVES, REDUCING

(See Regulators, Pressure).

VALVES, REGULATING

Atlas Valve Co., Newark, N. J.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Bristol Co., The, Waterbury, Conn.
Crane Co., Chicago, Ill.
Davis Regulator Co., G. M., Chicago, Ill.
Fulton Sylphon Co., Knoxville, Tenn.
Hornung, J. C., Chicago, Ill.
Illinois Engineering Co., Chicago, Ill.
Jenkins Bros., New York.
Kainer & Company, Chicago, Ill.
Kieley & Mueller, Inc., New York.
McAlear Mfg. Co., Chicago, Ill.
Mueller Co., Decatur, Ill.
Powers Regulator Co., Chicago, Ill.
Sarco Co., Inc., New York.
Walworth Co., New York

VALVES, RELIEF (WATER)

American Schaeffer & Budenberg Div., Consolidated Ashcroft Hancock Co., Inc., Brooklyn, N. Y.
Crane Co., Chicago, Ill.
Davis Regulator Co., G. M., Chicago, Ill.
Kainer & Company, Chicago, Ill.
Kennedy Valve Mfg. Co., Elmira, N. Y.
McAlear Mfg. Co., Chicago, Ill.
Mueller Co., Decatur, Ill.
National Radiator Corp., Johnstown, Pa.

VALVES, SAFETY

American District Steam Co., North Tonawanda, N. Y.
American Radiator Co., Buffalo, N. Y.
American Schaeffer & Budenberg Div., Consolidated Ashcroft Hancock Co., Inc., Brooklyn, N. Y.
Crane Co., Chicago, Ill.
Jenkins Bros., New York.
Kennedy Valve Mfg. Co., Elmira, N. Y.
National Radiator Corp., Johnstown, Pa.
Time-O-Stat Controls Co., Elkhart, Ind.
Walworth Co., New York

VALVES, STOP AND CHECK

(See Valves, Non-Return).

VENTILATING SYSTEMS

American Blower Co., Detroit, Mich.
American Radiator Co., Buffalo, N. Y.
Autovent Fan & Blower Co., Chicago, Ill.
Bayley Blower Co., Milwaukee, Wis.
Bishop & Babcock Sales Co., Cleveland, Ohio.
Buffalo Forge Co., Buffalo, N. Y.
Carrier Engineering Corp., Newark, N. J.
Clarage Fan Co., Kalamazoo, Mich.
Connor Co., Inc., The W. B., New York.
General Air Filters Corp., New York
Ilg Electric Ventilating Co., Chicago, Ill.
Nelson Corp., Herman, The, Moline, Ill.
Skinner Bros. Mfg. Co., St. Louis, Mo.
St. Louis Blow Pipe & Heater Co., Inc., St. Louis, Mo.
Sturtevant Co., B. F., Hyde Park Boston, Mass.
Wing Mfg. Co., L. J., New York.

VENTILATING SYSTEMS, ACID

Duriron Company, Inc., The, Dayton, O.

VENTILATORS

Bayley Blower Co., Milwaukee, Wis.
DeBothezat Impeller Co., Inc., New York
Sturtevant Co., B. F., Hyde Park Boston, Mass.

VENTILATORS, MUSHROOM

Aeolus Dickinson, Chicago, Ill.
American Blower Co., Detroit, Mich.
American Metal Products Corp., St. Louis, Mo.
Buffalo Forge Co., Buffalo, N. Y.
Clarage Fan Co., Kalamazoo, Mich.
Knowles Mushroom Ventilator Co., New York.
Ventilating Products Co., Chicago, Ill

VENTILATORS, ROOF

Aeolus Dickinson, Chicago, Ill.

VENTILATORS, UNIT

American Blower Co., Detroit, Mich
Ilg Electric Ventilating Co., Chicago, Ill.
Nelson Corp., Herman, The, Moline, Ill.
Peerless Unit Ventilation Co., Inc., Bridgeport, Conn.
Sturtevant Co., B. F., Hyde Park Boston, Mass.

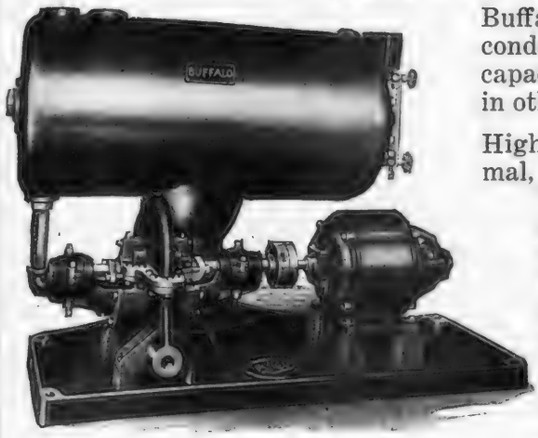
WEATHER STRIPS, METAL

Athey Co., Chicago, Ill.

WRENCHES, STILLSON

Walworth Co., New York.

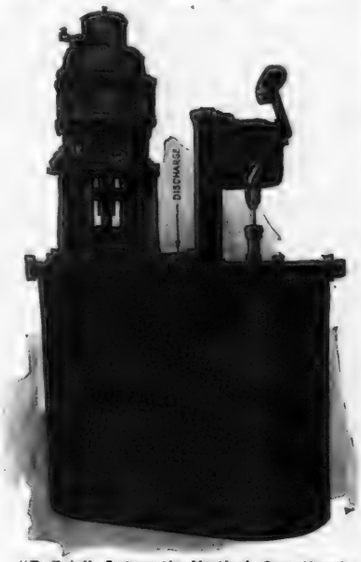
"Trouble-proof" Condensation Outfits



"Buffalo" Class "SL" Pump and Receiver

Buffalo Double Suction Class "SL" Pumps will handle 212° condensate without vaporizing, air binding, reduction in capacity or pressure and various other troubles that prevail in other condensate pumps.

High or low water temperatures, either above or below normal, do not overload these smooth running pumps. Absolutely self-priming. Made in several sizes, for all motor speeds with capacities up to 12,500 lbs. of condensate per hour, against heads up to 50 lbs.



"Buffalo" Automatic Vertical Centrifugal Pump and Receiver

Buffalo Automatic Vertical Centrifugal pump and receiver is very good for ordinary service, handling up to 10,000 lbs. of condensate per hour against heads up to 25 lbs. The heavy cast iron receiver, vertical ball bearing type thrust bearing, bronze impeller and sturdy construction in general make this outfit very practical where it is necessary to dig a pit to permit gravity drainage.

Bulletin No. 960-D tells the complete story.

Buffalo Steam Pump Co.

480 Broadway, Buffalo, N. Y.

IN CANADA: Canadian Blower & Forge Co., Ltd., Kitchener, Ontario.

No. 0 THERMOFLEX BLAST AND DRIP TRAP

Especially designed for dripping large supply mains, hot water heaters, unit heaters, etc. A small combination float and thermostatic trap. Self-supporting in the pipe line. Small, compact, and very efficient in operation. Low in cost, high in quality.

Send for Bulletin No. 52 A.

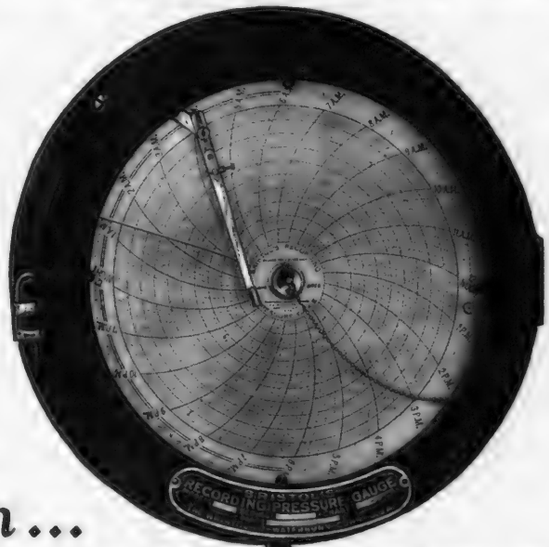
W. D. CASHIN COMPANY

35 HARTFORD ST., BOSTON, MASS.

TRADE MARK

BRISTOL'S

REG. U. S. PAT OFFICE.



In ...

the central heating plant steam pressures can be more uniformly controlled where operatives have guidance of continuous pressure records made by Bristol's Recording Gauges. These Bristol's Instruments are commonly installed to show boiler steam pressure—pressure of steam entering heating mains—end of line pressure, etc.

Simple design, rugged construction and careful calibration by expert workmen guarantee many years of accurate, trouble-free operation. Write for catalogs, bulletins, prices.

The Bristol Co., Waterbury, Conn.

ALPHABETICAL INDEX OF ADVERTISEMENTS

A

Absolute Con-Tac-Tor Corp. 146
Acme Radiator Shield Co. 132
Aeolus Dickinson 129
Aerofin Corporation 133
Alberger Heater Co. 160
Alexander Bros., Inc. 176
American Blower Co. 123
American District Steam Co. ... 163
American Gas Products Corp. ... 35
American Metal Products Corp. . 142
American Radiator Co. 47, 50
American Schaeffer & Budenberg Division, Consolidated Ashcroft Hancock Co., Inc. 138
American Steam Pump Co. 171
Ames Pump Co. 111
Armstrong Machine Works 135
Athey Co. 142
Atlas Valve Co. 134
Autovent Fan & Blower Co. ... 127

B

Badger & Sons Co., E. B. 31
Baldor Electric Co. 132
Banner Rock Products Co. 32
Barnes & Jones 173
Bayley Blower Co. 155
Bishop & Babcock Sales Co. 25
Bristol Co. 175
Brownell Co. 161
Bryan Steam Corp. 162
Buffalo Forge Co. 125
Buffalo Steam Pump Co. 175
Burnham Boiler Corp. 16

C

Carrier Air Conditioning Co. of America 125
Carrier Engineering Corp. 147
Cashin Co., W. D. 175
Celotex Co. 34
Central Station Steam Co. 142
Century Electric Co. 48
Chace Valve Co., W. M. 129
Chicago Pump Co. 169
Circulair Heat, Inc. 49
Cissell Mfg. Co., W. M. 173
Clarage Fan Co. ...Inside Front Cover
Cleveland Gas Burner & Appliance Co. 52
Coatesville Boiler Works 7
Consolidated Ashcroft Hancock Co., Inc. 138
Copper & Brass Research Assn... 40
Crane Co. 29

D

Dahlquist Mfg. Co. 161
Davis Engineering Corp. 154
Davis Regulator Co., G. M. 140
DeBothezat Impeller Co. 136
Doremus & Co. 124
Dunham Co., C. A. 18, 19
Duriron Co., Inc. 134
Dwyer Equipment Co. 164

E

Economy Pumping Machinery Co. 113
Electrol, Inc. 26
Emerson Electric Mfg. Co. 167

F

Fitzgibbons Boiler Co. 39
Flax-li-num Insulating Co. 30
Foster Wheeler Corp. 156
Foxboro Co., Inc. 157
Frank Heater & Engineering Co., Inc., O. E. 134
Frost Mfg. Co. 15
Fulton Sylphon Co. 36, 37

G

General Air Filters Corp. 130
Gorton Heating Corp. 138
Grinnell Co., Inc. 117

H

Haines & Co., Wm. S. 160
Hardinge Brothers, Inc. 28
Hartmann Co., Chas. 171
Healy-Ruff Co. 164
Heggie-Simplex Boiler Co. ..34 A & B
Hoffman Specialty Co. ....Back Cover
Hornung, J. C. 160
Horton Mfg. Co. 150

I

Ilg Electric Ventilating Co. 143
Illinois Engineering Co. 62
Illinois Malleable Iron Co. 158
Insulite Co. 33
International Fuel Service Corp.. 161

J

Janette Mfg. Co. 132
Jenkins Bros. 44
Johnson Service Co. 46
Johnston Brothers, Inc. 157

K

Kainer & Company 159
Kennedy Valve Mfg. Co. 5
Kewanee Boiler Corp. 3
Kieley & Mueller, Inc. 150
King-Seeley Corp. 12
Knowles Mushroom Ventilator Co. 164

L

Lytton Mfg. Co. 127

M

Marsh & Co., Jas. P. 178
Marsh Valve Co. 45
McAlear Mfg. Co. 60
McDonnell & Miller 24
McIlvaine Burner Corp. 147
McQuay Radiator Corp. 38
Mercoid Corp., The 141
Modine Mfg. Co. 126
Monitor Boiler Co. 20
Mueller Co. 21

N

Nash Engineering Co. 118, 177
National Air Filter Co. 148
National Pipe Bending Co. 166
National Radiator Corp. 11
National Regulator Co. 162
National Tube Co. 14
Nelson Corp., Herman 41
Newport Boiler Co. 138
New York Blower Co. 131
Nugent & Co., Inc., Wm. W.... 167

P

Pacific Steel Boilers Corp. 4
Page Boiler Co., Wm. H. 6
Patterson-Kelley Co. 150
Peerless Heater Co. 154
Peerless Unit Ventilation Co.... 149
Phillips Drill Co. 140
Pierce, Butler & Pierce Mfg. Corp. 8, 9
Powers Regulator Co. 109
Preferred Oil Burners, Inc. 115

R

Raymond, F. I. 151
Reed Air Filter Co., Inc. ..... —
Ric-wiL Co. 165
Rome Brass Radiator Corp. 43
Rome-Turney Radiator Co. 130
Ross Heater & Mfg. Co. 140

S

Sarco Co. .....Front Cover
Schutte & Koerting Co. ..... —
Sheer Co., H. M. 154
Simplex Heating Specialty Co... 159
Sims Co. 155
Skidmore Corp. 173
Skinner Bros. Mfg. Co. 53
Spang, Chalfant & Co., Inc. 13
St. Louis Blow Pipe & Heater Co., Inc. 147
Stanwood Corp. 10
Staynew Filter Corp. 129
Sterling Engineering Co. 166
Sturtevant Co., B. F. 121, 130
Swartwout Co. 159

T

Teeple Co., L. R. 134
Thermal Units Co. 128
Thrush & Co., H. A. 17
Time-O-Stat Controls Co.....146, 153
Trane Co. 42
Trerice Co., H. O. 142

V

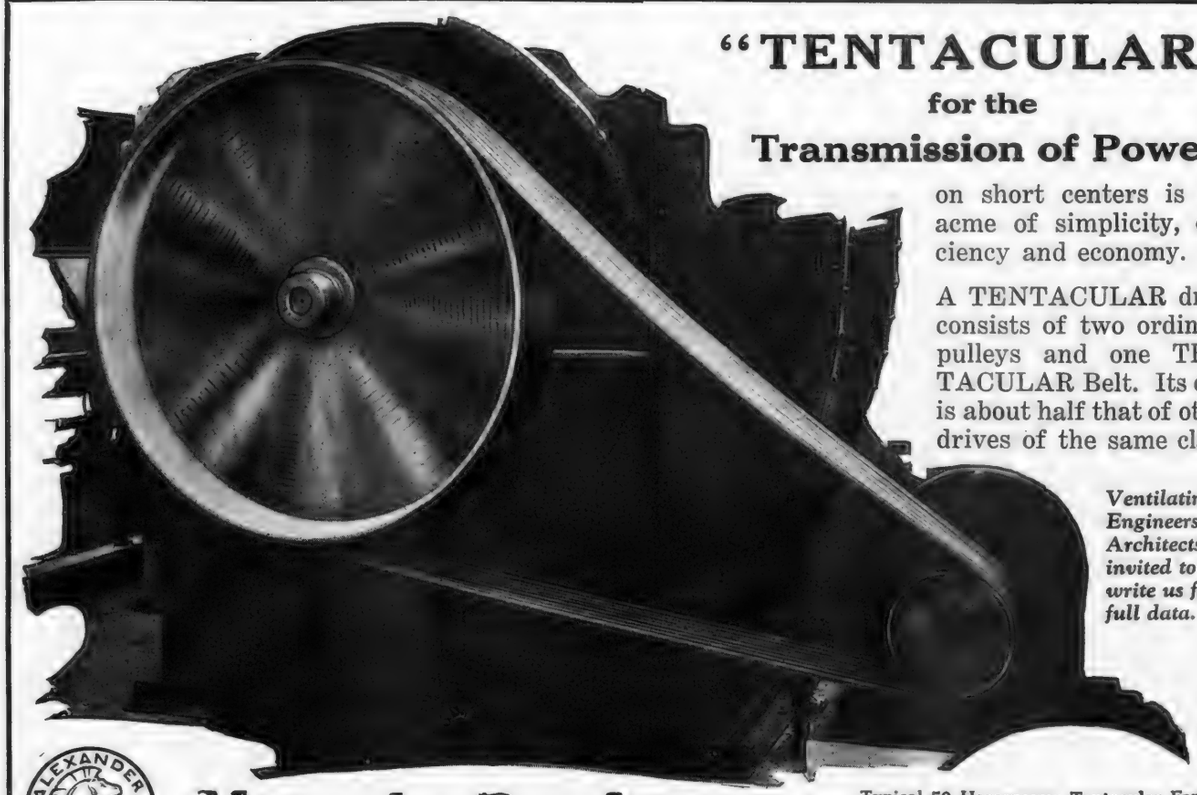
Vapor Engineering Co. 130
Ventilating Products Co. 129
Vilter Mfg. Co. ..... —
Vinco Company, Inc. 156

W

Walworth Co. 22
Want Ads. 124
Webster & Co., Warren..... 23
Webster Electric Co. 27
Weil-McLain Co....Inside Back Cover
Weil Pump Co. 171
White Mfg. Co. 152
Whitlock Coil Pipe Co..... 158
Wing Mfg. Co., L. J. 137
Wolverine Tube Co. 140

Y

York Heating and Ventilating Corp. 145
Young Radiator Co. 152



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for the
Transmission of Power

on short centers is the acme of simplicity, efficiency and economy.

A TENTACULAR drive consists of two ordinary pulleys and one TENTACULAR Belt. Its cost is about half that of other drives of the same class.

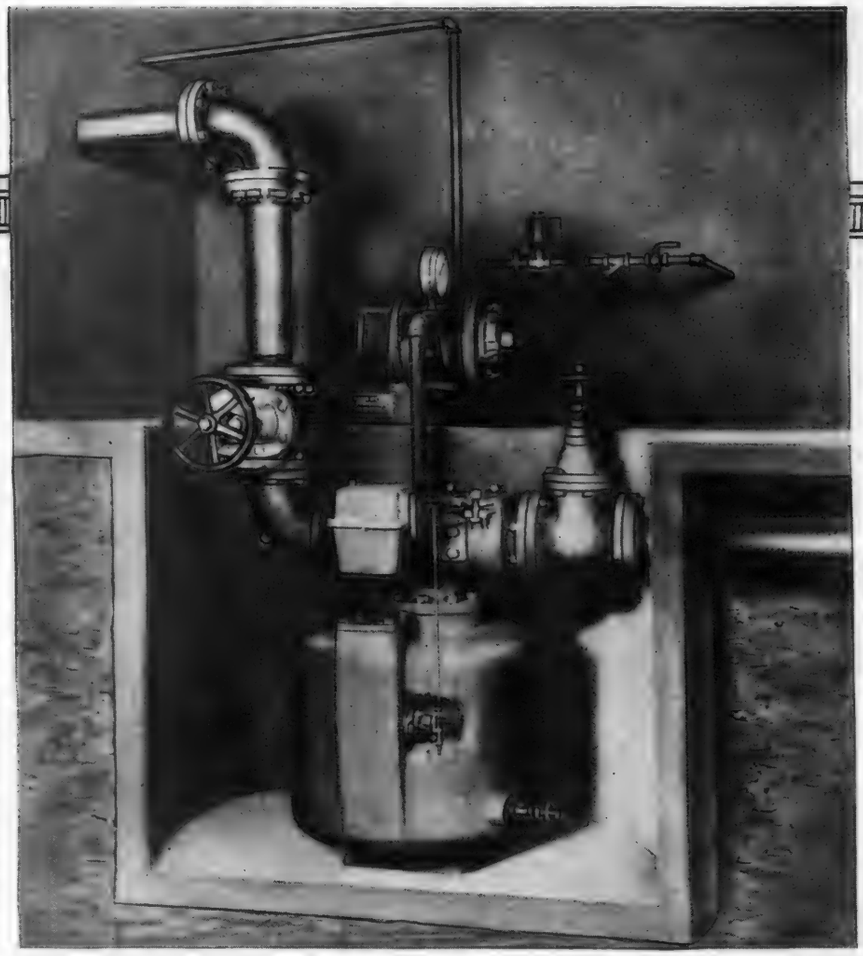
Ventilating Engineers and Architects are invited to write us for full data.

Typical 50 Horsepower Tentacular Fan Drive

Alexander Brothers, Inc. 19 South Street, PHILADELPHIA, PA.

Sole Makers of Tentacular Transmission Belt

Branches and Distributors in All Principal Cities.



This small Jennings Sewage Ejector has a capacity of 30 g.p.m. Other sizes are furnished in capacities ranging from 50 to 1500 g.p.m. Heads up to 50 ft.

For small jobs . . .

where economy counts

THE thirty gallon Jennings Sewage Ejector—a new addition to the Jennings line—provides a low-cost unit of just the right size for small sewage handling jobs. Odorless in operation—with a capacity ample for serving five toilets—it is compact and easily installed in any out-of-the-way basement corner.

Because the Jennings Ejector operates pneumatically, nothing passes through the pumping element but air. Efficiency cannot become impaired by the caking of solid matter on moving parts. No screenage need be provided, for anything is readily handled that will enter the receiving pot through the four inch inlet pipe.

Jennings Sewage Ejectors are used to advantage in pumping unscreened sewage and grease drainage from buildings where toilets or drain pipes are below street sewer level—moving crude sewage and drainage from low-lying districts—handling effluent and Imhoff sludge at disposal plants.

Write for Bulletin 67.

Return Line and Air Line Vacuum Heating Pumps; Condensation Pumps; Compressors and Vacuum Pumps for Air and Gases; Standard and Suction Centrifugal Pumps; House Service Pumps; Sewage Ejectors; Sump Pumps; Flat Box Pumps; Marine Pumps

Jennings Pumps

THE NASH ENGINEERING CO 81 WILSON ROAD, SOUTH NORWALK, CONN.

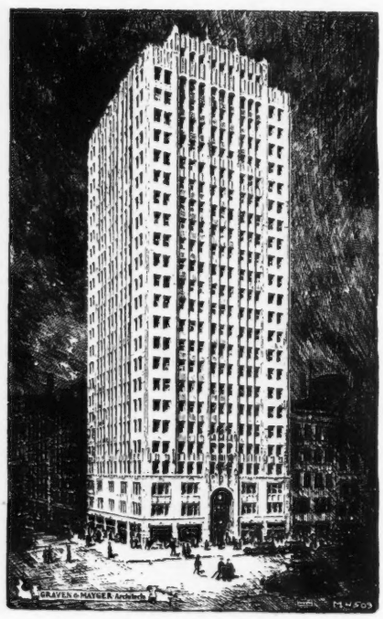
MARSH SYSTEMS

1868 M 1928

JAS. P. MARSH & CO.

MARSH MERKUSTAT

Consistent with growth and progress, backed by over sixty years' experience, Jas. P. Marsh & Co.'s organization offer for your inspection and approval a complete working model of their Hi-lo Systems in both Vacuum and Vapor, also the Marsh Merkustat exhibited at the 4th Annual Power Show, Coliseum, Chicago, February 12th to 17th, 1929.



Booths 422-423

LAWYERS BUILDING
Architects: Graven & Mayger
Heating Contractor: Wendt & Crone Co.
Consulting Engineer: W. F. Clark

5000 EAST END AVENUE
Architect: Robert De Goyler
Engineers and Builders: Friedstein & Co.
Heating Contractors: Mehring & Hanson
Consulting Engineer: H. L. Clute

Progressive development likewise prevails in our 1929 showing of Marsh Indicating and Recording Gauges, Marval and Thermodisc Air Valves, Reflux Radiator Traps and Reflux Packless Radiator Valves. Marsh-made Thermometers will be shown in various color schemes to harmonize with the modern boiler beautiful. Marsh modernizes the complete heating system with mature experience and judgment in the various uses of each factor involved in every phase of heating.

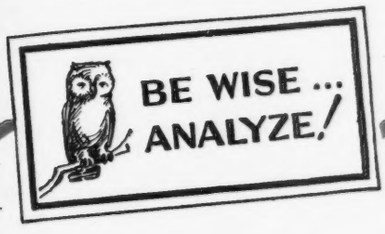
JAS. P. MARSH & CO.

2073 Southport Avenue, CHICAGO 551—5th Avenue, NEW YORK CITY

Other Offices in Principal Cities

Alike, yet perhaps very different!

Here are two watermelons. They look *alike. But are they equally good to eat? You can't be sure... until you* check what's inside.



Similarly, the construction of various boilers, when given only a casual examination, often seems much alike. But when you carefully "check what's inside" the boilers may differ widely. Hence, the alert steamfitter analyzes. And what does he find?

Take the Weil-McLain Jacketed Boiler as an example. When he analyzes this boiler

. . . ***for fuel combustion,*** he finds that all grates in the fire box are shaking grates; he also finds rounded "live fire" corners in the fire box and added combustion space.

. . . ***for heat utilization,*** he finds *balanced* back-and-forth fire travel; with no short cuts to the chimney under *any* condition; besides, he finds extra heating surface at every point.

. . . ***for owner's convenience,*** he finds an extra high ashpit; automatic draft regulation; and convenient front control of the choke damper.

. . . ***for meeting modern fuel trends,*** he finds extra fuel capacity for handling coke; also larger water spaces and large nipple openings for free circulation to utilize the quick heat from oil burners.

. . . ***for easy installation,*** he finds individual tie rods for assembly of sections; two conveniently located washout plugs; a skimming or blow off plug; provision for hot water coil and indirect water heater; doors securely hung on separate frames; no parts attached to boiler with bolts that *screw* into cored castings.

In short, when you analyze Weil-McLain Boilers, you see evidences at every hand of scientific research, skillful engineering, and careful thought for users of the boilers, as well as for the heating contractor who installs them. They are supremely efficient. They *fight fuel waste.*

WEIL-McLAIN COMPANY

General Offices	*Boiler Factory*	*Radiator Factory*
Chicago, Illinois	Michigan City, Indiana	Erie, Pa.

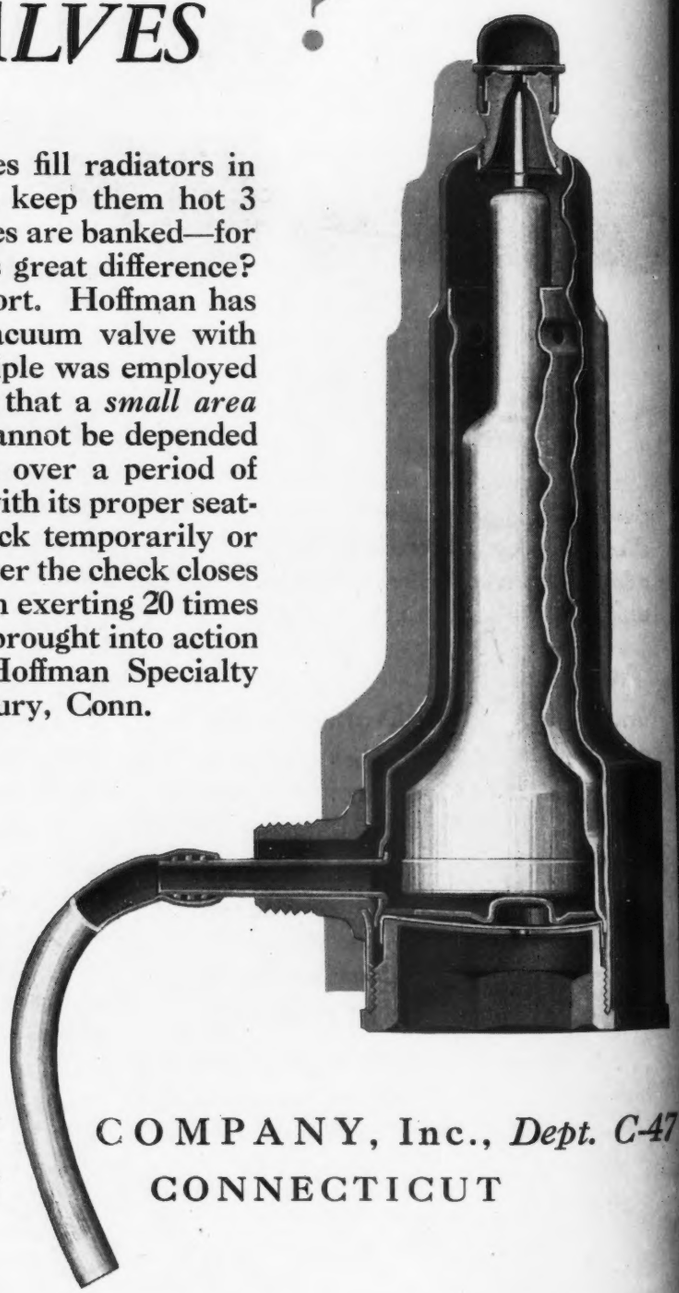
Weil-McLain
SCIENTIFIC COMBUSTION
BOILERS

"SEE THE WEIL-McLAIN JOBBER IN YOUR TERRITORY"

What . . .

makes this great difference in the HOFFMAN NO. 2 *VACUUM VALVES* ?

Hoffman No. 2 Vacuum Valves fill radiators in 15 minutes (not an hour) and keep them hot 3 hours (not 30 minutes) after fires are banked—for 1/3 less fuel. What makes this great difference? Chiefly a tightly closed vent port. Hoffman has perfected (and patented) a vacuum valve with "double air locks." This principle was employed because tests definitely proved that a *small area* check of the disc or ball type cannot be depended on to maintain a tight closure over a period of time. Dirt or scale interferes with its proper seating. So Hoffman uses the check temporarily or as a "vacuum-starter" only. After the check closes the port, a *large area* diaphragm exerting 20 times greater pressure on the port is brought into action absolutely locking out air. Hoffman Specialty Co., Inc., Dept. C-47, Waterbury, Conn.



Write for booklet
"LOCKING OUT AIR—
THE HEAT THIEF"

HOFFMAN SPECIALTY COMPANY, Inc., *Dept. C-47*
WATERBURY CONNECTICUT